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PART I.

EXPERIMENTS IN PLANT HYBRIDISATION.

By GREGOR MENDEL.

With an Introductory Note by W. BATESON, M.A., F.R.S.

The original paper, of which the following pages are a translation, was published by Gregor Mendel in the year 1865 *in the "Abhandlungen des naturforschenden Vereines in Brünn," Bd. iv. That periodical is little known, and probably there are not half a dozen copies in the libraries of this country. It will consequently be a matter for satisfaction that the Royal Horticultural Society has undertaken to publish a translation of this extraordinarily valuable contribution to biological science.*

The conclusion which stands out as the chief result of Mendel's admirable experiments is of course the proof that in respect of certain pairs of differentiating characters the germ-cells of a hybrid, or cross-bred, are pure, *being carriers and transmitters of either the one character or the other, not both. That he succeeded in demonstrating this law for the simple cases with which he worked it is scarcely possible to doubt.*

In so far as Mendel's law applies, therefore, the conclusion is forced upon us that a living organism is a complex of characters, of which some, at least, are dissociable and are capable of being replaced by others. We thus reach the conception of **unit-characters,** *which may be rearranged in the formation of the reproductive cells. It is hardly too much to say that the experiments which led to this advance in knowledge are worthy to rank with those that laid the foundation of the Atomic laws of Chemistry.*

To what extent Mendel's conclusions will be found to apply to other characters, and to other plants and animals, further experiment alone can show. Though little has yet been done, we already know a considerable group of cases in which the law holds, but we also have tolerably clear evidence that many phenomena of cross-breeding point to the coexistence of other laws of a much higher order of complexity. When the paper before us was written Mendel apparently inclined to the view that, with modifications,

his law might be found to include all the phenomena of hybridisation, but in a brief subsequent paper on hybrids of the genus Hieracium* *he clearly recognised the existence of unconformable cases.*

Nevertheless, however much it may be found possible to limit or to extend the principle discovered by Mendel, there can be no doubt that we have in his work not only a model for future experiments of the same kind, but also a solid foundation from which the problem of Heredity may be attacked in the future.

It may seem surprising that a work of such importance should so long have failed to find recognition and to become current in the world of science. It is true that the journal in which it appeared is scarce, but this circumstance has seldom long delayed general recognition. The cause is unquestionably to be found in the neglect of the experimental study of the problem of Species which supervened on the general acceptance of the Darwinian doctrines. The problem of Species, as Gärtner, Kölreuter, Naudin, Mendel, and the other hybridists of the first half of the nineteenth century conceived it, attracted thenceforth no workers. The question, it was imagined, had been answered and the debate ended. No one felt any interest in the matter. A host of other lines of work were suddenly opened up, and in 1865 *the more vigorous investigators naturally found those new methods of research more attractive than the tedious observations of the hybridisers, whose inquiries were supposed, moreover, to have led to no definite result. But if we are to make progress with the study of Heredity, and to proceed further with the problem "What* is *a Species?" as distinct from the other problem "How do Species survive?" we must go back and take up the thread of the inquiry exactly where Mendel dropped it.*

As was stated in a lecture to the Royal Horticultural Society in 1900 *it is to De Vries, Correns, and Tschermak that we owe the simultaneous rediscovery, confirmation and extension of Mendel's work. References*† *are there given to the chief recent publications relating to the subject, of which the number is rapidly increasing.*

The whole paper abounds with matters for comment and criticism, which could only be profitable if undertaken at some length. There are also many deductions and lines of inquiry to which Mendel's facts point, which we in a fuller knowledge of physiology can perceive. It may, however, be doubted whether in his own day his conclusions could have been extended.

As some biographical particulars respecting this remarkable investigator will be welcome, I subjoin the following brief notice, which was published by Correns ‡ *on the authority of Dr. von Schanz: Gregor Johann Mendel was born on July* 22, 1822, *at Heinzendorf bei Odrau, in Austrian Silesia. He was the son of well-to-do peasants. In* 1843 *he entered as a novice the "Königinkloster," an Augustinian foundation in Altbrünn. In* 1847 *he was ordained priest. From* 1851 *to* 1853 *he studied physics and natural science at Vienna. Thence he returned to his cloister and became a teacher in the Realschule at Brünn. Subsequently he was*

* *Abh. Naturf. Brünn*, viii. 1869, p. 26.
† *Journal Royal Horticultural Society*, 1900, xxv. p. 54.
‡ *Bot. Zeitg.* lviii. 1900, No. 15, p. 229.

made Abbot, and died January 6, 1884. *The experiments described in his papers were carried out in the garden of his Convent.*

Besides the two papers on hybridisation, dealing respectively with Pisum *and* Hieracium, *Mendel contributed to the Brünn journal observations of a meteorological character, but, so far as I am aware, no others relating to natural history.*—W. Bateson.]

Introductory Remarks.

Artificial fertilisation, such as is effected with decorative plants in order to obtain new variations in colour, has led up to the experiments which will here be discussed. The striking regularity with which the same hybrid forms always reappeared whenever fertilisation took place between the same species induced further experiments to be undertaken, the object of which was to follow up the developments of the hybrids in their progeny.

To this object numerous careful observers, such as Kölreuter, Gärtner, Herbert, Lecoq, Wichura and others, have devoted a part of their lives with inexhaustible perseverance. Gärtner especially, in his work "Die Bastarderzeugung im Pflanzenreiche" (The Production of Hybrids in the Vegetable Kingdom), has recorded very valuable observations; and quite recently Wichura published the results of some profound investigations into the hybrids of the Willow. That, so far, no generally applicable law governing the formation and development of hybrids has been successfully formulated can hardly be wondered at by anyone who is acquainted with the extent of the task, and can appreciate the difficulties with which experiments of this class have to contend. A final decision can only be arrived at when we shall have before us the results of detailed experiments made on plants belonging to the most diverse orders.

Those who survey the work done in this department will arrive at the conviction that among all the numerous experiments made, not one has been carried out to such an extent and in such a way as to permit of the possibility of determining the number of different forms under which the offspring of hybrids appear, or so that these forms may be arranged with certainty according to their separate generations, or that their mutual numerical relations can be definitely ascertained.

It requires indeed some courage to undertake a labour of such far-reaching extent; it appears, however, to be the only right way by which we can finally reach the solution of a question the importance of which cannot be overestimated in connection with the history of the evolution of organic forms.

The paper now presented records the results of such a detailed experiment. This experiment was appropriately confined to a small plant group, and is now, after eight years' pursuit, concluded in all essentials. Whether the plan upon which the separate experiments were conducted and carried out was the best suited to attain the desired end is left to the friendly decision of the reader.

Selection of the Trial Plants.

The value and utility of any experiment are determined by the fitness of the material to the purpose for which it is used, and thus in

the case before us it cannot be immaterial what plants are subjected to experiment and in what manner such experiments are conducted.

The selection of the plant group which shall serve for experiments of this class must be made with all possible care if it be desired to avoid at the outset every risk of questionable results.

The trial plants must necessarily—

1. Possess constant differentiating characters.

2. The hybrids of such plants must, during the flowering period, be protected from the influence of all foreign pollen, or be easily capable of such protection.

The hybrids and their offspring should suffer no marked disturbance in their fertility in the successive generations.

Accidental impregnation by foreign pollen, if such occurred during the experiments and were not recognised, would lead to entirely erroneous conclusions. Reduced fertility or entire sterility of certain forms, such as occurs in the offspring of many hybrids, would render the trials very difficult or entirely frustrate them. In order to discover the relations in which the hybrid forms stand towards each other and also towards their progenitors it appears to be necessary that all members of the series developed in each successive generation should be, *without exception*, subjected to observation.

At the very outset special attention was devoted to the *Leguminosæ* on account of their peculiar floral structure. Experiments which were made with several members of this family led to the result that the genus *Pisum* was found to possess the necessary conditions.

Some thoroughly distinct forms of this genus possess characters which are constant, and easily and certainly recognisable, and when their hybrids are mutually crossed they yield perfectly fertile progeny. Furthermore, a disturbance through foreign pollen cannot easily occur, since the fertilising organs are closely packed within the keel and the anther bursts within the bud, so that the stigma becomes covered with pollen even before the flower opens. This circumstance is of especial importance. As additional advantages worth mentioning, there may be cited the easy culture of these plants in the open ground and in pots, and also their relatively short period of growth. Artificial fertilisation is certainly a somewhat elaborate process, but nearly always succeeds. For this purpose the bud is opened before it is perfectly developed, the keel is removed, and each stamen carefully extracted by means of forceps, after which the stigma can at once be dusted over with the foreign pollen.

In all, thirty-four more or less different varieties of Peas were obtained from several seedsmen and subjected to a two years' trial. In the case of one variety there were remarked, among a larger number of plants all alike, a few forms which were markedly different. These, however, did not vary in the following year, and agreed entirely with another variety obtained from the same seedsmen; the seeds were therefore doubtless merely accidentally mixed. All the other varieties yielded perfectly constant and similar offspring; at any rate, no essential difference was observed during the two trial years. For fertilisation twenty-two of these were selected and cultivated during the whole period of the experiments. They remained constant without any exception.

Their systematic classification is difficult and uncertain. If we adopt the strictest definition of a species, according to which only those individuals belong to a species which under precisely the same circumstances display precisely similar characters, no two of them could be imputed to one species. According to the opinion of experts, however, the majority belong to the species *Pisum sativum*; while the rest are regarded and classed, some as sub-species of *P. sativum*, and some as independent species, such as *P. quadratum*, *P. saccharatum*, and *P. umbellatum*. The positions, however, which may be assigned to them in a classificatory system are quite immaterial for the purposes of the experiments in question. It has so far been found to be just as impossible to draw a sharp line between the hybrids of species and varieties as between species and varieties themselves.

Division and Arrangement of the Experiments.

If two plants which differ constantly in one or several characters be crossed, numerous experiments have demonstrated that the common characters are transmitted unchanged to the hybrids and their progeny; but each pair of differentiating characters, on the other hand, unite in the hybrid to form a new character, which in the progeny of the hybrid is usually variable. The object of the trial was to observe these variations in the case of each pair of differentiating characters, and to deduce the law according to which they appear in the successive generations. The trial resolves itself therefore into just as many separate experiments as there are constantly differentiating characters presented in the trial plants.

The various forms of Peas selected for crossing showed differences in the length and colour of the stem; in the size and form of the leaves; in the position, colour, and size of the flowers; in the length of the flower stalk; in the colour, form, and size of the pods; in the form and size of the seeds; and in the colour of the seed-coats and the albumen [cotyledons]. Some of the characters noted do not permit of a sharp and certain separation, since the difference is of a "more or less" nature, which is often difficult to define. Such characters could not be utilised for the separate trials; these could only be confined to characters which stand out clearly and definitely in the plants. Lastly, the result must show whether they, in their entirety, observe a regular relation in their hybrid unions, and whether from these facts any conclusion can be come to regarding those characters which possess a subordinate significance in the type.

The characters which were selected for the trials relate:

1. To the *difference in the form of the ripe seeds*. These are either round or roundish, the wrinkling, when such occurs on the surface, being always only shallow; or they are irregularly angular and deeply wrinkled (*P. quadratum*).

2. To the *difference in the colour of the seed albumen* (endosperm).* The albumen of the ripe seeds is either pale yellow, bright yellow and orange coloured, or it possesses a more or less intense green tint. This difference of colour is easily seen in the seeds, as their coats are transparent.

* [Mendel uses the terms "albumen" and "endosperm" somewhat loosely to denote the cotyledons, containing food-material, within the seed.—W. B.]

3. To the *difference in the colour of the seed-coat.* This is either white, with which character white flowers are constantly correlated; or it is grey, grey-brown, leather-brown, with or without violet spotting, in which case the colour of the standards is violet, that of the wings purple, and the stem in the axils of the leaves is of a reddish tint. The grey seed-coats become dark brown in boiling water.

4. To the *difference in the form of the ripe pods.* These are either simply inflated, never contracted in places; or they are deeply constricted between the seeds and more or less wrinkled (*P. saccharatum*).

5. To the *difference in the colour of the unripe pods.* They are either light to dark green, or vividly yellow, in which colouring the stalks, leaf-veins, and blossom participate.*

6. To the *difference in the position of the flowers.* They are either axial, that is, distributed along the main stem; or they are terminal, that is, bunched at the top of the stem and arranged almost in a false umbel; in this case the upper part of the stem is more or less widened in section (*P. umbellatum*).

7. To the *difference in the length of the stem.* The length of the stem† is very various in some forms; it is, however, a constant character for each, in so far that in healthy plants, grown in the same soil, it is only subject to unimportant variations.

In trials with this character, in order to be able to discriminate with certainty, the long axis of 6—7 ft. was always crossed with the short one of ¾ ft. to 1½ ft.

Each two of the differentiating characters enumerated above were united by cross-fertilisation. There were made for the

1st	trial	60	fertilisations	on	15	plants.
2nd	,,	58	,,	,,	10	,,
3rd	,,	35	,,	,,	10	,,
4th	,,	40	,,	,,	10	,,
5th	,,	23	,,	,,	5	,,
6th	,,	34	,,	,,	10	,,
7th	,,	37	,,	,,	10	,,

From a larger number of plants of the same variety only the most vigorous were chosen for fertilisation. Weakly plants afford always uncertain results, because even in the first generation of hybrids, and still more so in the subsequent ones, many of the offspring either entirely fail to flower or only form a few and inferior seeds.

Furthermore, in all the trials reciprocal crossings were effected in such a way, that is, that each of the two varieties which in one set of fertilisations served as seed-bearers in the other set were used as pollen plants.

The plants were grown in garden beds, a few also in pots, and were maintained in their natural upright position by means of sticks, branches

* One species possesses a beautifully brownish-red coloured pod, which when ripening turns to violet and blue. Trials with this character were only begun last year. [Of these further experiments it seems no account was published.]

† [In my account of these experiments (*R.H.S. Journal*, vol. xxv. p. 54) I misunderstood this paragraph and took "axis" to mean the *floral* axis, instead of the main axis of the plant. The unit of measurement, being indicated in the original by a dash, I thus took to have been an *inch*, but the translation here given is evidently correct.—W. B.]

of trees, and strings stretched between. For each trial a number of pot plants were placed during the blooming period in a greenhouse, to serve as control plants with respect to the main trial in the open as regards possible disturbance by insects. Among the insects* which visit Peas the beetle *Bruchus pisi* might be detrimental to the trials should they appear in numbers. The female of this species is known to lay the eggs in the flower, and in so doing opens the keel; upon the tarsi of one specimen, which was caught in a flower, some pollen grains could clearly be seen under a lens. Mention must also be made of a circumstance which possibly might lead to the introduction of foreign pollen. It occurs, for instance, in some rare cases that certain parts of an otherwise quite normally developed flower wither, which results in a partial exposure of the fertilising organs. A defective development of the keel has also been observed, owing to which the stigma and anthers remained partially uncovered. It also sometimes happens that the pollen does not reach full perfection. In this event there occurs a gradual lengthening of the stigma during the blooming period, until the stigmatic tip protrudes at the point of the keel. This remarkable appearance has also been observed in hybrids of *Phaseolus* and *Lathyrus*.

The risk of false impregnation by foreign pollen is, however, a very slight one with *Pisum*, and is quite incapable of disturbing the general result. Among more than 10,000 plants which were carefully examined there were only a very few cases where an indubitable false impregnation had occurred. Since in the greenhouse such a case was never remarked, it may well be supposed that *Bruchus pisi*, and possibly also the described abnormalities in the floral structure, were to blame.

The Forms of the Hybrids.†

Experiments which in previous years were made with decorative plants have already afforded evidence that the hybrids, as a rule, are not exactly intermediate between the parental species. With some of the more striking characters, those, for instance, which relate to the form and size of the leaves, the pubescence of the several parts, &c., the intermediate, indeed, was nearly always to be seen; in other cases, however, one of the two parental characters was so preponderant that it was difficult, or quite impossible, to detect the other in the hybrid.

This is precisely the case with Pea hybrids. In the case of each of the seven crosses the hybrid character resembles that of one of the parental forms so closely that the other either escapes observation completely or cannot be detected with certainty. This circumstance is of great importance in the determination and classification of the forms under which the offspring of the hybrids appear. Henceforth in this paper those characters which are transmitted entirely, or almost unchanged in the hybridisation, and therefore in themselves represent the hybrid characters, are termed the *dominant*, and those which become latent in the process *recessive*. The expression "recessive" has been chosen

* [It is somewhat surprising that no mention is made of Thrips, which swarm in Pea flowers.]

† [Mendel throughout speaks of his cross-bred Peas as "hybrids," a term which many restrict to the offspring of two distinct *species*. He, as he explains, held this to be only a question of degree.—W. B.]

because the characters thereby designated withdraw or entirely disappear in the hybrids, but nevertheless reappear unchanged in their progeny, as will be demonstrated later on.

It was furthermore shown by the whole of the experiments that it is perfectly immaterial whether the dominant character belong to the seed-bearer or to the pollen parent; the form of the hybrid remains identical in both cases. This interesting fact was also emphasised by Gärtner, with the remark that even the most practised expert is not in a position to determine in a hybrid which of the two parental species was the seed or the pollen plant.

Of the differentiating characters which were used in the experiments the following are dominant:—

1. The round or roundish form of the seed with or without shallow depressions.

2. The yellow colouring of the seed albumen [cotyledons].

3. The grey, grey-brown, or leather-brown colour of the seed-coat, in connection with violet-red blossoms and reddish spots in the leaf axils.

4. The simply inflated form of the pod.

5. The green colouring of the unripe pod in connection with the same colour in the stems, the leaf-veins and the calyx.

6. The distribution of the flowers along the stem.

7. The greater length of stem.

With regard to this last character it must be stated that the longer of the two parental stems is usually exceeded by the hybrid, which is possibly only attributable to the greater luxuriance which appears in all parts of plants when stems of very different length are crossed. Thus, for instance, in repeated experiments, stems of 1 ft. and 6 ft. in length yielded without exception hybrids which varied in length between 6 ft. and $7\frac{1}{2}$ ft.

The seeds of hybrids in the experiments with seed-coat are often more spotted, and the spots sometimes coalesce into small bluish-violet patches. The spotting also frequently appears even when it is absent as a parental character.

The hybrid forms of the seed-shape and of the albumen are developed immediately after the artificial fertilisation by the mere influence of the foreign pollen. They can, therefore, be observed even in the first trial year, whilst all the other characters naturally only appear in the following year in such plants as have been raised from the crossed seed.

The First Generation from the Hybrids.

In this generation there reappear, together with the dominant characters, also the recessive ones with their full peculiarities, and this occurs in the definitely expressed average proportion of three to one, so that among each four plants of this generation three receive the dominant character and one the recessive. This relates without exception to all the characters which were embraced in the trials. The angular wrinkled form of the seed, the green colour of the albumen, the white colour of the seed-coats and the flowers, the constrictions of the pods, the yellow colour of the unripe pod, of the stalk, the calyx, and the leaf venation, the umbel-like form of the inflorescence, and the dwarfed stem, all reappear in

the numerical proportion given without any essential alteration. *Transitional forms were not observed in any experiment.*

Once the hybrids resulting from reciprocal crosses are fully formed, they present no appreciable difference in their subsequent development, and consequently the results [of the reciprocal crosses] can be reckoned together in each experiment. The relative numbers which were obtained for each pair of different characters are as follows:—

Trial 1. Form of seed.—From 253 hybrids 7,324 seeds were obtained n the second trial year. Among them were 5,474 round or roundish ones and 1,850 angular wrinkled ones. Therefrom the relation is deduced of 2·96 to 1.

Trial 2. Colour of albumen.—258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their relation, therefore, is as 3·01 to 1.

In these two trials each pod yielded usually both kinds of seed. In well-developed pods which contained on the average six to nine seeds, it often occurred that all the seeds were round (Trial 1) or all yellow (Trial 2); on the other hand there were never observed more than five angular or five green ones in one pod. It appears to make no difference whether the pods are developed early or later in the hybrid or whether they spring from the main axis or from a lateral one. In some few plants only a few seeds developed in the first formed pods, and these possessed exclusively one of the two characters, but in the subsequently developed pods the normal proportions were maintained nevertheless.

As in separate pods, so did the distribution of the characters vary in separate plants. By way of illustration the first ten individuals from both series of trials may serve.

	Trial 1. Form of Seed.		Trial 2. Colour of Albumen.	
Plants.	Round.	Angular.	Yellow.	Green.
1	45	12	25	11
2	27	8	32	7
3	24	7	14	5
4	19	10	70	27
5	32	11	24	13
6	26	6	20	6
7	88	24	32	13
8	22	10	44	9
9	28	6	50	14
10	25	7	44	18

As extremes in the distribution of the two seed characters in one plant, there were observed in Trial 1 an instance of 43 round and only 2 angular, and another of 14 round and 15 angular seeds. In Trial 2 there was a case of 32 yellow and only 1 green seed, but also one of 20 yellow and 19 green.

These two trials are important for the determination of the average relative figures, because with a smaller number of trial plants they show that very considerable fluctuations may occur. In counting the seeds, also, especially in Trial 2, some care is requisite, since in some of the seeds of many plants the green colour of the albumen is less developed, and at first may be easily overlooked. The cause of the partial disappearance of

the green colouring has no connection with the hybrid character of the plants, as it likewise occurs in the parental variety. This peculiarity is also confined to the individual and is not inherited by the offspring. In luxuriant plants this appearance was frequently noted. Seeds which are damaged by insects during their development often vary in colour and form, but with a little practice in sorting errors are easily avoided. It is almost superfluous to mention that the pods must remain on the plants until they are thoroughly ripened and have become dried, since it is only then that the shape and colour of the seed are fully developed.

Trial 3. Colour of the seed-coats.—Among 929 plants 705 bore violet-red flowers and grey-brown seed-coats; 224 had white flowers and white seed-coats. Thence results the proportion 3·15 to 1.

Trial 4. Form of pods.—Of 1,181 plants 882 had them simply inflated, and in 299 they were constricted. Resulting proportion, 2·95 to 1.

Trial 5. Colour of the unripe pods.—The number of trial plants was 580, of which 428 had green pods and 152 yellow ones. Consequently these stand in proportion as 2·82 to 1.

Trial 6. Position of flowers.—Among 858 cases 651 blossoms were axial and 207 terminal. Proportion, 3·14 to 1.

Trial 7. Length of stem.—Out of 1,064 plants, in 787 cases the stem was long, and in 277 short. Hence a mutual proportion of 2·84 to 1. In this trial the dwarfed plants were carefully lifted and transferred to a special bed. This precaution was necessary, as otherwise they would have perished through being overgrown by their tall relatives. Even in their quite young state they can be easily picked out by their compact growth and thick dark-green foliage.

If now the results of the whole of the trials be brought together, there is found, as between the number of forms with the dominant and recessive characters, an average proportion of 2·98 to 1, or 3 to 1.

The dominant character can have here a *double significance*—viz. that of the parental character, or the character of the hybrid. In which of the two significations it appears in each separate case can only be determined by the following generation. As a parental character it must be transmitted unchanged to the whole of the offspring; as a hybrid character, on the other hand, it must observe the same proportion as in the first generation.

The Second Generation from the Hybrids.

Those forms which in the first generation maintain the recessive character do not further vary in the second generation as regards this character; they remain constant in their offspring.

It is otherwise with those which possess the dominant character in the first generation. Of these *two*-thirds yield offspring which display the dominant and recessive characters in the proportion of 3 to 1, and thereby show exactly the same ratio as the hybrid forms, while only *one*-third remains with the dominant character constant.

The separate trials yielded the following results:—

Trial 1.—Among 565 plants which were raised from round seeds of the first generation, 193 yielded round seeds only, and remained therefore

constant in this character; 372, however, gave both round and angular seeds, in the proportion of 3 to 1. The number of the hybrids, therefore, as compared with the constants is 1·93 to 1.

Trial 2.—Of 519 plants which were raised from seeds whose albumen was of yellow colour in the first generation, 166 yielded exclusively yellow, while 353, however, yielded yellow and green seeds in the proportion of 3 to 1. There resulted, therefore, a splitting into hybrid and constant forms in the proportion of 2·13 to 1.

For each separate trial in the following experiments 100 plants were selected which displayed the dominant character in the first generation, and in order to ascertain the significance of this, ten seeds of each were cultivated.

Trial 3.—The offspring of 36 plants yielded exclusively grey-brown seed-coats, while 64 plants yielded partly grey-brown and partly white.

Trial 4.—The offspring of 29 plants had only simply inflated pods; of the offspring of 71, on the other hand, some had inflated and some constricted.

Trial 5.—The offspring of 40 plants had only green pods; of the offspring of 60 plants some had green, some yellow ones.

Trial 6.—The offspring of 33 plants had only axial flowers; of the offspring of 67, on the other hand, some had axial and some terminal flowers.

Trial 7.—The offspring of 28 plants inherited the long axis, and those of 72 plants some the long and some the short axis.

In each of these trials a certain number of the plants came constant with the dominant character. For the determination of the proportion in which the separation of the forms with the constantly persistent character results, the two first trials are of especial importance, since in these a larger number of plants can be compared. The ratios 1·93 to 1 and 2·13 to 1 gave together almost exactly the average ratio of 2 to 1. The sixth trial has a quite concordant result; in the others the ratio varies more or less, as was only to be expected in view of the smaller number of 100 trial plants. Trial 5, which shows the greatest departure, was repeated, and then in lieu of the ratio of 60 and 40 that of 65 and 35 resulted. *The average ratio of 2 to 1 appears, therefore, as fixed with certainty.* It is therefore demonstrated that, of those forms which possess the dominant character in the first generation, in two-thirds the hybrid character is embodied, while one-third remains constant with the dominant character.

The ratio of 3 to 1, in accordance with which the distribution of the dominant and recessive characters results in the first generation, resolves itself therefore in all trials into the ratio of 2 : 1 : 1 if the dominant character be differentiated according to its significance as a hybrid character or a parental one. Since the members of the first generation spring directly from the seed of the hybrids, *it is now clear that the hybrids form seeds having one or other of the two differentiating characters, and of these one-half develop again the hybrid form, while the other half yield plants which remain constant and receive the dominant and recessive characters in equal numbers.*

THE SUBSEQUENT GENERATIONS FROM THE HYBRIDS.

The proportions in which the descendants of the hybrids develop and split up in the first and second generations presumably hold good for all subsequent progeny. Trials 1 and 2 have already been carried through six generations, 3 and 7 through five, and 4, 5, and 6 through four, these trials being continued from the third generation with a small number of plants, and no departure from the rule has been perceptible. The offspring of the hybrids separated in each generation in the ratio of 2 : 1 : 1 into hybrids and constant forms.

If A be taken as denoting one of the two constant characters, for instance the dominant, a, the recessive, and Aa the hybrid form in which both are conjoined, the formula

$$A + 2Aa + a$$

shows the order of development for the progeny of the hybrids of two differentiating characters.

The observation made by Gärtner, Kolreuter, and others, that hybrids are inclined to revert to the parental forms, is also confirmed by the trials described. It is seen that the number of the hybrids which arise from one fertilisation, as compared with the number of forms which become constant and the progeny of such from generation to generation, is continually diminishing, but that nevertheless they could not entirely disappear. If there be assumed an average equality of fertility in all plants in all generations, and that, furthermore, each hybrid forms seed of which one-half yields hybrids again, while the other half is constant to both characters in equal proportions, the ratio of numbers for the offspring in each generation is seen by the following summary, in which A and a denote again the two parental characters, and Aa the hybrid forms. For brevity's sake it may be assumed that each plant in each generation furnishes only 4 seeds.

				RATIOS.
Generation	A	Aa	a	A : Aa : a
1	1	2	1	1 : 2 : 1
2	6	4	6	3 : 2 : 3
3	28	8	28	7 : 2 : 7
4	120	16	120	15 : 2 : 15
5	496	32	496	31 : 2 : 31
n				$2^n-1 : 2 : 2^n-1$

In the tenth generation, for instance, $2^n-1=1023$. There result, therefore, in each 2,048 plants which arise in this generation 1,023 with the constant dominant character, 1,023 with the recessive character, and only two hybrids.

THE OFFSPRING OF HYBRIDS IN WHICH SEVERAL DIFFERENTIATING CHARACTERS ARE ASSOCIATED.

In the trials above described plants were used which differed only in one essential character. The next task consisted in ascertaining whether the law of development discovered in these applied to each pair of differentiating characters when several diverse characters are united in the hybrid

by crossing. As regards the form of the hybrids in these cases, the trials showed throughout that this invariably more nearly approaches to that one of the two parental plants which possesses the greater number of dominant characters. If, for instance, the seed plant has a short stem, terminal white flowers, and simply inflated pods; the pollen plant, on the other hand, a long stem, violet-red flowers distributed along the stem, and constricted pods, the hybrid resembles the seed parent only in the form of the pod; in the other characters it agrees with the pollen parent. Should one of the two parental types possess only dominant characters, then the hybrid is scarcely or not at all distinguishable from it.

Two trials were made with a larger number of plants. In the first trial the parental plants differed in the form of the seed and in the colour of the albumen; in the second in the form of the seed, in the colour of the albumen, and in the colour of the seed-coats. Trials with seed characters give the result in the simplest and most certain way.

In order to facilitate study of the data in these trials, the different characters of the seed plant will be indicated by A, B, C, those of the pollen plant by a, b, c, and the hybrid forms of these characters by Aa, Bb, and Cc.

Trial 1.—AB, seed parents;	ab, pollen parents;
A, form round;	a, form angular;
B, albumen yellow.	b, albumen green.

The fertilised seeds appeared round and yellow like those of the seed parents. The plants raised therefrom yielded seeds of four sorts, which frequently presented themselves in one pod. In all 556 seeds were yielded by 15 plants, and of these there were:—

315 round and yellow,
101 angular and yellow,
108 round and green,
32 angular and green.

All were sown the following year. Eleven of the round yellow seeds did not yield plants, and three plants did not form seeds. Among the rest:

38 had round yellow seeds	AB
65 round yellow and green seeds	ABb
60 round yellow and angular yellow seeds . . .	AaB
138 round yellow and green, angular yellow and green seeds	AaBb.

From the angular yellow seeds 96 resulting plants bore seed, of which:

28 had only angular yellow seeds	aB
68 angular yellow and green seeds	aBb.

From 108 round green seeds 102 resulting plants fruited, of which:

35 had only round green seeds	Ab
67 round and angular green seeds	Aab.

The angular green seeds yielded 30 plants which bore seeds all of like character; they remained constant ab.

The offspring of the hybrids appeared therefore under nine different

forms and partly in very unequal numbers. When these are collected and co-ordinated we find:

38	plants	with the	sign	AB
35	"	"	"	Ab
28	"	"	"	aB
30	"	"	"	ab
65	"	"	"	ABb
68	"	"	"	aBb
60	"	"	"	AaB
67	"	"	"	Aab
138	"	"	"	AaBb

The whole of the forms may be classed into three essentially different groups. The first embraces those with the signs AB, Ab, aB, and ab: they possess only constant characters and do not vary again in the next generation. Each of these forms is represented on the average thirty-three times. The second group embraces the signs ABb, aBb, AaB, Aab: these are constant in one character and hybrid in another, and vary in the next generation only as regards the hybrid character. Each of these appears on an average sixty-five times. The form AaBb occurs 138 times: it is hybrid in both characters, and behaves exactly as do the hybrids from which it is derived.

If the numbers in which the forms of these sections appear be compared, the ratios of 1, 2, 4 are unmistakably evident. The numbers 32, 65, 138 present very favourable approximations to the ratio numbers of 33, 66, 132.

The developmental series consists, therefore, of nine classes, of which four appear therein always once and are constant in both characters; the forms AB, ab resemble the parental forms, the two others present combinations between the conjoined characters A, a, B, b, which combinations are likewise possibly constant. Four classes appear always twice, and are constant in one character and hybrid in the other. One class appears four times, and is hybrid in both characters. Consequently the offspring of the hybrids, if two kinds of differentiating characters are combined therein, are developed according to the formula

$$AB+Ab+aB+ab+2\ ABb+2\ aBb+2\ AaB+2\ Aab+4\ AaBb.$$

This developmental series is incontestably a combination series in which the two developmental series for the characters A and a, B and b, are combined. We arrive at the full number of the classes of the series by the combination of the formulæ:

$$A+2\ Aa+a$$
$$B+2\ Bb+b.$$

Second Trial.—ABC, seed parents;	abc, pollen parents;
A, form round;	a, form angular;
B, albumen yellow;	b, albumen green;
C, seed-coat grey-brown.	c, seed-coat white.

This trial was made in precisely the same way as the previous one. Among all the trials it demanded the most time and trouble. From 24 hybrids 687 seeds were obtained in all: these were all either spotted, grey-

brown or grey-green, round or angular. From these in the following year 689 plants fruited, and, as further investigation showed, there were among them :

8	plants	ABC.	22	plants	ABCc.	45	plants	ABbCc.
14	„	ABc.	17	„	AbCc.	36	„	aBbCc.
9	„	AbC.	25	„	aBCc.	38	„	AaBCc.
11	„	Abc.	20	„	abCc.	40	„	AabCc.
8	„	aBC.	15	„	ABbC.	49	„	AabbC.
10	„	aBc.	18	„	ABbc.	48	„	AaBbc.
10	„	abC.	19	„	aBbC.			
7	„	abc.	24	„	aBbc.			
			14	„	AaBC.	78	„	AaBbCc.
			18	„	AaBc.			
			20	„	AabC.			
			16	„	Aabc.			

The developmental series embraced 27 classes. Of these 8 are constant in all characters, and each appears on the average 10 times; 12 are constant in two characters, and hybrid in the third, each appears on the average 19 times; 6 are constant in one character and hybrid in the other two; each appears on the average 43 times. One form appears 78 times and is hybrid in all of the characters. The ratios 10, 19, 43, 78 agree so closely with the ratios 10, 20, 40, 80, or 1, 2, 4, 8, that this last undoubtedy represents the true value.

The development of the hybrids when the original parents differ in three characters results therefore according to the following formula :

ABC + ABc + AbC + Abc + aBC + aBc + abC + abc + 2 ABCc + 2 AbCc + 2 aBCc + 2 abCc + 2 ABbC + 2 ABbc + 2 aBbC + 2 aBbc + 2 AaBC + 2 AaBc + 2 AabC + 2 Aabc + 4 ABbCc + 4 aBbCc + 4 AaBCc + 4 AabCc + 4 AaBbC + 4 AaBbc + 8 AaBbCc.

Here also is involved a combination series in which the developmental series for the characters A and a, B and b, C and c, are united. The formulæ

$$A+2\,Aa+a$$
$$B+2\,Bb+b$$
$$C+2\,Cc+c$$

give all the classes of the series. The constant combinations which occur therein agree with all combinations which are possible between the characters A, B, C, a, b, c; two thereof, ABC and abc, resemble the two original parental stocks.

In addition, further experiments were made with a smaller number of trial plants in which the remaining characters by twos and threes were united as hybrids: all yielded approximately the same results. There is therefore no doubt that for the whole of the characters involved in the trials the principle applies that *the offspring of the hybrids in which several essentially different characters are combined represent the components of a series of combinations, in which the developmental series for each two different characters are associated.* It is demonstrated at the

same time that *the relation of each two different characters in hybrid connection is independent of the other differences in the two original parental stocks.*

If n represent the number of the characteristic differences in the two original stocks, 3^n gives the number of components of the combination series, 4^n the number of individuals which belong to the series, and 2^n the number of connections which remain constant. The series therefore embraces, if the original stocks differ in four characters, $3^4=81$ component classes, $4^4=256$ individuals, and $2^4=16$ constant forms; or, which is the same, among each 256 offspring of the hybrids there are 81 different combinations, 16 of which are constant.

All constant combinations which in Peas are possible by the combination of the said seven characteristic features were actually obtained by repeated crossing. Their number is given by $2^7=128$. Thereby is simultaneously given the practical proof *that the constant characters which appear in various forms of a plant group may be obtained in all the associations which are possible according to the laws of combination by means of repeated artificial fertilisation.*

As regards the flowering time of the hybrids, the trials are not yet concluded. It can, however, already be stated that the period stands almost exactly between those of the seed and pollen parents, and that the development of the hybrids with respect to this character probably happens in the same way as in the case of the other characters. The forms which are selected for trials of this class must have a difference of at least twenty days from the middle flowering period of one to that of the other; furthermore, the seeds when sown must all be placed at the same depth in the earth, so that they may germinate simultaneously. Also, during the whole flowering period, the more important variations in temperature must be taken into account, and the partial hastening or delaying of the flowering which may result therefrom. It is clear that this experiment presents many difficulties to be overcome and necessitates great attention.

If we endeavour to collate in a brief form the results arrived at, we find that those differentiating characters which admit of easy and certain recognition in the trial plants all behave exactly alike in their hybrid associations. The offspring of the hybrids of each pair of differentiating characters are, one-half, hybrid again, while the other half are constant in equal proportions with the characters of the seed and pollen parents respectively. If several differentiating characters are combined by cross-fertilisation in a hybrid, the resulting offspring form the components of a combination series in which the developmental series for each pair of differentiating characters are united.

The uniformity of behaviour shown by the whole of the characters submitted to trial permits, and fully justifies, the acceptance of the principle that a similar relation exists in the other characters which appear less sharply defined in plants, and therefore could not be included in the separate experiments. An experiment with peduncles of different lengths gave on the whole a fairly satisfactory result, although the differentiation and serial arrangement of the forms could not be effected with that certainty which is indispensable for correct experiment.

THE REPRODUCTIVE CELLS OF HYBRIDS.

The results of the previously described experiments induced further experiments, the results of which appear fitted to afford some conclusions as regards the composition of the egg and pollen cells of hybrids. An important basis for argument is afforded in *Pisum* by the circumstance that among the progeny of the hybrids constant forms appear, and that this occurs, too, in all combinations of the associated characters. So far as experience goes, we find it in every case confirmed that constant progeny can only be formed when the egg cells and the fertilising pollen are of like character, so that both are provided with the material for vitalising quite similar individuals, as is the case with the normal fertilisation of pure species. We must therefore regard it as essential that exactly similar factors are at work also in the production of the constant forms in the hybrid plants. Since the various constant forms are produced in *one* plant, or even in *one* flower of a plant, the conclusion appears logical that in the ovaries of the hybrids there are formed as many sorts of egg cells, and in the anthers as many sorts of pollen cells, as there are possible constant combination forms, and that these egg and pollen cells agree in their internal composition with those of the separate forms.

In point of fact it is possible to demonstrate theoretically that this hypothesis would fully suffice to account for the development of the hybrids in the separate generations, if we might at the same time assume that the various kinds of egg and pollen cells were formed in the hybrids on the average in equal numbers.

In order to bring these assumptions experimentally to the proof, the following trials were selected. Two forms which were constantly different in the form of the seed and the colour of the albumen were united by fertilisation.

If the differentiating characters are again indicated as A, B, a, b, we have:

AB, seed parent;	ab, pollen parent;
A, form round;	a, form angular;
B, albumen yellow.	b, albumen green.

The artificially fertilised seeds were sown together with several seeds of both original stocks, and the most vigorous examples were chosen for the reciprocal crossing. There were fertilised:—

1. The hybrids with the pollen of AB.
2. The hybrids „ „ ab.
3. AB „ „ the hybrids.
4. ab „ „ the hybrids.

For each of these four trials the whole of the flowers on three plants were fertilised. If the above theory be correct, there must be developed on the hybrids egg and pollen cells of the forms AB, Ab, aB, ab, and there would be combined:—

1. The egg cells	AB, Ab, aB, ab	with the pollen cells	AB.
2. „	AB, Ab, aB, ab	„ „	ab.
3. „	AB	„ „	AB, Ab, aB, ab.
4. „	ab	„ „	AB, Ab, aB, ab.

From each of these trials there could then result only the following forms :—

1. AB, ABb, AaB, AaBb.
2. AaBb, Aab, aBb, ab.
3. AB, ABb, AaB, AaBb.
4. AaBb, Aab, aBb, ab.

If, furthermore, the several forms of the egg and pollen cells of the hybrids were produced on an average in equal numbers, then in each trial the said four combinations should stand in the same numerical relation. A perfect agreement in the numerical relations was, however, not to be expected, since in each fertilisation, even in normal cases, some egg cells remain undeveloped or subsequently die, and many even of the well-formed seeds fail to germinate when sown. The above assumption is also limited in so far that, while it demands the formation of an equal number of the various sorts of egg and pollen cells, it does not require that this should apply to each separate hybrid with mathematical exactness.

The first and second trials had pre-eminently the object of proving the composition of the hybrid egg cells, while the third and fourth trials were to decide that of the pollen cells. As is shown by the above demonstration the first and second trials and the third and fourth trials should produce precisely the same combinations, and even in the second year the result should be partially visible in the form and colour of the artificially fertilised seed. In the first and third trials the dominant characters of form and colour, A and B, appear in each union, and are also partly constant and partly in hybrid union with the recessive characters a and b, for which reason they must impress their peculiarity upon the whole of the seeds. All seeds should therefore appear round and yellow, if the theory be justified. In the second and fourth trials, on the other hand, one union is hybrid in form and in colour, and consequently the seeds are round and yellow; another is hybrid in form, but constant in the recessive character of colour, whence the seeds are round and green; the third is constant in the recessive character of form but hybrid in colour, consequently the seeds are angular and yellow; the fourth is constant in both recessive characters, so that the seeds are angular and green. In both these trials there were consequently four sorts of seed to be expected—viz. round and yellow, round and green, angular and yellow, angular and green.

The crop fulfilled these expectations perfectly. There were obtained in the

1st Trial, 98 exclusively round yellow seeds ;
3rd „ 94 „ „ „ „

In the 2nd Trial, 31 round and yellow, 26 round and green, 27 angular and yellow, 26 angular and green seeds.

In the 4th Trial, 24 round and yellow, 25 round and green, 22 angular and yellow, 27 angular and green seeds.

A favourable result could now scarcely be doubted; the next generation must afford the final proof. From the seed sown there resulted for the

first trial 90 plants, and for the third 87 plants which fruited: these yielded for the—

1st Experiment	3rd Experiment		
20	25	round yellow seeds	AB.
23	19	round yellow and green seeds . . .	ABb.
25	22	round and angular yellow seeds . .	AaB.
22	21	round and angular green and yellow seeds	AaBb.

In the second and fourth trials the round and yellow seeds yielded plants with round and angular yellow and green seeds, AaBb.

From the round green seeds plants resulted with round and angular green seeds, Aab.

The angular yellow seeds gave plants with angular yellow and green seeds, aBb.

From the angular green seeds plants were raised which yielded again only angular green seeds, ab.

Although in these two trials likewise some seeds did not germinate, the figures arrived at already in the previous year were not affected thereby, since each kind of seed gave plants which, as regards their seed, were like each other and different from the others. There resulted therefore from the

2nd Experiment	4th Experiment		
31	24	plants of the form	AaBb
26	25	,, ,,	Aab.
27	22	,, ,,	aBb.
26	27	,, ,,	ab.

In all the trials, therefore, there appeared all the forms which the proposed theory demands, and also in nearly equal numbers.

In a further trial the characters of floral colour and length of stem were experimented upon, and selection so made that in the third trial-year each character ought to appear in half of all the plants if the above theory were correct. A, B, a, b serve again as indicating the various characters.

A, violet-red flowers.	a, white flowers.
B, axis long.	b, axis short.

The form Ab was fertilised with ab, which produced the hybrid Aab. Furthermore, aB was also fertilised with ab, whence the hybrid aBb. In the second year, for further fertilisation, the hybrid Aab was used as seed parent, and hybrid aBb as pollen parent.

Seed parent, Aab.	Pollen parent, aBb.
Possible egg cells, Abab.	Pollen cells, aBab.

From the fertilisation between the possible egg and pollen cells four combinations should result, viz.:—

$$AaBb + aBb + Aab + ab.$$

From this it is perceived that, according to the above theory, in the third trial-year out of all the plants

The half should have	violet-red flowers (Aa),	Classes	1, 3
„ „ „	white flowers (a)	„	2, 4
„ „ „	a long axis (Bb)	„	1, 2
„ „ „	a short axis (b)	„	3, 4

From 45 fertilisations of the second year 187 seeds resulted, of which only 166 reached the flowering stage in the third year. Among these the separate classes appeared in the numbers following :—

Class.	Colour of flower.	Stem.	
1	violet-red	long	47 times
2	white	long	40 „
3	violet-red	short	38 „
4	white	short	41 „

There consequently appeared—

The violet-red flower colour	(Aa)	in 85	plants.
„ white „ „	(a)	in 81	„
„ long stem	(Bb)	in 87	„
„ short „	(b)	in 79	„

The theory adduced is therefore satisfactorily confirmed in this trial also.

For the characters of form of pod, colour of pod, and position of flowers experiments were also made on a small scale, and results obtained in perfect agreement. All combinations which were possible through the union of the differentiating characters duly appeared, and in nearly equal numbers.

Experimentally, therefore, the theory is justified that *pea hybrids form egg and pollen cells which, in their constitution, represent in equal numbers all constant forms which result from the combination of the characters when conjoined by fertilisation.*

The difference of the forms among the progeny of the hybrids, as well as the relative ratio of numbers in which they are observed, find a sufficient explanation in the principle above deduced. The simplest case is afforded by the developmental series of each pair of differentiating characters. This series is expressed by the formula A+2Aa+a, in which A and a signify the forms with constant differentiating characters, and Aa the hybrid form of both. It includes in three different classes four individuals. In the formation of these, pollen and egg cells of the form A and a take part on the average equally in the fertilisation; hence each form twice, since four individuals are formed. There participate consequently in the fertilisation—

The pollen cells A+A+a+a
The egg cells A+A+a+a.

It remains, therefore, purely a matter of chance which of the two sorts of pollen will become united with each separate egg cell. According, however, to the law of probability, it will always happen, on the average of many cases, that each pollen form A and a will unite equally often with each egg cell form A and a, consequently one of the two pollen cells A in the fertilisation will meet with the egg cell A and the

other with an egg cell a, and so likewise one pollen cell a, will unite with an egg cell A, and the other with egg cell a.

Pollen cells A A a a.

Egg cells A A a a.

The result of the fertilisation may be made clear by putting the signs for the conjoined egg and pollen cells in the form of fractions, those for the pollen cells above and those for the egg cells below the line. We then have

$$\frac{A}{A}+\frac{A}{a}+\frac{a}{A}+\frac{a}{a}.$$

In the first and fourth factor the egg and pollen cells are of like kind, consequently the product of their union must be constant, viz. A and a; in the second and third, on the other hand, there again results a union of the two differentiating characters of the stocks, consequently the forms resulting from these fertilisations are identical with those of the hybrid from which they sprang. *There occurs accordingly a repeated hybridisation.* This explains the striking fact that the hybrids are able to produce, besides the two parental forms, offspring which are like themselves; $\frac{A}{a}$ and $\frac{a}{A}$ both give the same union Aa, since, as already remarked above, it makes no difference in the result of fertilisation to which of the two characters the pollen or egg cells belong. We may write then—

$$\frac{A}{A}+\frac{A}{a}+\frac{a}{A}+\frac{a}{a}=A+2\ Aa+a.$$

This represents the average result of the self-fertilisation of the hybrids when two differentiating characters are united in them. In solitary flowers and in solitary plants, however, the ratios in which the forms of the series are produced may suffer not inconsiderable fluctuations. Apart from the fact that the numbers in which both sorts of egg cells occur in the seed vessels can only be regarded as equal on the average, it remains purely a matter of chance which of the two sorts of pollen may fertilise each separate egg cell. For this reason the separate values must necessarily be subject to fluctuations, and there are even extreme cases possible, as were described earlier in connection with the experiments with the form of the seed and the colour of the albumen. The true ratios of the numbers can only be ascertained by an average deduced from the sum of as many single values as possible; the greater the number the more are merely chance elements eliminated.

The developmental series for hybrids in which two kinds of differentiating characters are united contains among sixteen individuals nine different forms, viz., AB + Ab + aB + ab + 2 ABb + 2 aBb + 2 AaB + 2 Aab + 4 AaBb. Between the differentiating characters of the original stocks Aa and Bb four constant combinations are possible, and consequently the hybrids produce the corresponding four forms of egg and pollen cells AB, Ab, aB, ab, and each of these will on the average figure four times in the fertilisation,

since sixteen individuals are included in the series. Therefore the participators in the fertilisation are—

Pollen cells AB + AB + AB + AB + Ab + Ab + Ab + Ab + aB + aB + aB + aB + ab + ab + ab + ab.

Egg cells AB + AB + AB + AB + Ab + Ab + Ab + Ab + aB + aB + aB + aB + ab + ab + ab + ab.

In the process of fertilisation each pollen form unites on an average equally often with each egg cell form, so that each of the four pollen cells AB unites once with one of the forms of egg cell AB, Ab, aB, ab. In precisely the same way the rest of the pollen cells of the forms Ab, aB, ab unite with all the other egg cells. We obtain therefore—

$$\frac{AB}{AB}+\frac{AB}{Ab}+\frac{AB}{aB}+\frac{AB}{ab}+\frac{Ab}{AB}+\frac{Ab}{Ab}+\frac{Ab}{aB}+\frac{Ab}{ab}+$$

$$\frac{aB}{AB}+\frac{aB}{Ab}+\frac{aB}{aB}+\frac{aB}{ab}+\frac{ab}{AB}+\frac{ab}{Ab}+\frac{ab}{aB}+\frac{ab}{ab},$$

or

AB + ABb + AaB + AaBb + ABb + Ab + AaBb + Aab + AaB + AaBb + aB + aBb + AaBb + Aab + aBb + ab = AB + Ab + aB + ab + 2 ABb + 2 aBb + 2 AaB + 2 Aab + 4 AaBb.*

In precisely similar fashion is the developmental series of hybrids exhibited when three kinds of differentiating characters are conjoined in them. The hybrids form eight various kinds of egg and pollen cells-ABC, ABc, AbC, Abc, aBC, aBc, abC, abc—and each pollen form unites itself again on the average once with each form of egg cell.

The law of combination of different characters which governs the development of the hybrids finds therefore its foundation and explanation in the principle enunciated, that the hybrids produce egg cells and pollen cells which in equal numbers represent all constant forms which result from the combination of characters united by fertilisation.

Experiments with Hybrids of other Species of Plants.

It must be the object of further experiments to ascertain whether the law of development discovered for *Pisum* applies also to the hybrids of other plants. To this end several experiments were recently commenced. Two minor experiments with species of *Phaseolus* have been completed, and may be here mentioned.

A trial with *Phaseolus vulgaris* and *Phaseolus nanus* gave results in perfect agreement. *Ph. nanus* had together with the dwarf axis simply inflated green pods. *Ph. vulgaris* had, on the other hand, an axis 10 feet to 12 feet high, and yellow coloured pods, constricted when ripe. The ratios of the numbers in which the different forms appeared in the separate generations were the same as with *Pisum*. Also the development of the constant combinations resulted according to the law of simple combination of characters, exactly as in the case of *Pisum*. There were obtained—

* [In the original the sign of equality (=) is here represented by +, evidently a misprint.—W. B.]

Constant combinations.	Axis.	Colour of the unripe pods.	Form of the ripe pods.
1	long	green	inflated
2	„	„	constricted
3	„	yellow	inflated
4	„	„	constricted
5	short	green	inflated
6	„	„	constricted
7	„	yellow	inflated
8	„	„	constricted

The green colour of the pod, the inflated forms, and the long axis were, as in *Pisum*, dominant characters.

Another trial with two very different species of *Phaseolus* had only a partial result. *Phaseolus nanus*, L., served as seed parent, a perfectly constant species, with white flowers in short bunches and small white seeds in straight, inflated, smooth pods; as pollen parent was used *Ph. multiflorus*, W., with tall winding stem, purple-red flowers in very long bunches, rough, sickle-shaped crooked pods, and large seeds which bore black flecks and splashes on a peach-blood-red ground.

The hybrids had the greatest similarity to the pollen parent, but the flowers appeared less intensely coloured. Their fertility was very limited; from seventeen plants, which together developed many hundreds of flowers, only forty-nine seeds in all were obtained. These were of medium size, and were flecked and splashed similarly to those of *Ph. multiflorus*, while the ground colour was not materially different. The next year forty-four plants were raised from these seeds, of which only thirty-one reached the flowering stage. The characters of *Ph. nanus*, which had been altogether latent in the hybrids, reappeared in various combinations; their ratio, however, with relation to the dominant characters was necessarily very fluctuating owing to the small number of trial plants. With certain characters, as in those of the axis and the form of pod, it was, however, as in the case of *Pisum*, almost exactly 1 : 3.

Insignificant as the results of this trial may be as regards the determination of the relative numbers in which the various forms appeared, it presents, on the other hand, the phenomenon of a remarkable change of colour in the flowers and seed of the hybrids. In *Pisum* it is known that the characters of the flower- and seed-colour present themselves unchanged in the first and further generations, and that the offspring of the hybrids display exclusively the one or the other of the characters of the original stocks. It is otherwise in the experiment we are considering. The white flowers and the seed-colour of *Ph. nanus* appeared, it is true, at once in the first generation in one fairly fertile example, but the remaining thirty plants developed flower colours which were of various grades of purple-red to pale violet. The colouring of the seed-coat was no less varied than that of the flowers. No plant could rank as fully fertile; many produced no fruit at all; others only yielded fruits from the flowers last produced, and did not ripen. From fifteen plants only were well-developed seeds obtained. The greatest disposition to infertility was seen in the forms with preponderantly red flowers, since out of sixteen of these only four yielded ripe seed. Three of these had a similar seed pattern to

Ph. multiflorus, but with a more or less pale ground colour; the fourth plant yielded only one seed of plain brown tint. The forms with preponderantly violet coloured flowers had dark brown, black-brown, and quite black seeds.

The trial was continued through two more generations under similar unfavourable circumstances, since even among the offspring of fairly fertile plants there were still some which were less fertile or even quite sterile. Other flower—and seed—colours than those cited did not subsequently present themselves. The forms which in the first generation contained one or more of the recessive characters remained, as regards these, constant without exception. Also of those plants which possessed violet flowers and brown or black seed, some did not vary again in these respects in the next generation; the majority, however, yielded, together with offspring exactly like themselves, some which displayed white flowers and white seed-coats. The red flowering plants remained so slightly fertile that nothing can be said with certainty as regards their further development.

Despite the many disturbing factors with which the observations had to contend, it is nevertheless seen by this experiment that the development of the hybrids, with regard to those characters which concern the form of the plants, follows the same laws as does *Pisum*. With regard to the colour characters, it certainly appears difficult to perceive a substantial agreement. Apart from the fact that from the union of a white and a purple-red colouring a whole series of colours results, from purple to pale violet and white, the circumstance is a striking one that among thirty-one flowering plants only one received the recessive character of the white colour, while in *Pisum* this occurs on the average in every fourth plant.

Even these enigmatical results, however, might probably be explained by the law governing *Pisum* if we might assume that the colour of the flowers and seeds of *Ph. multiflorus* is a combination of two or more entirely independent colours, which individually act like any other constant character in the plant. If the flower colour A were a combination of the individual characters $A_1 + A_2 + \ldots$ which produce the total impression of a purple colouration, then by fertilisation with the differentiating character of the white colour a there would be produced the hybrid unions $A_1a + A_2a + \ldots$ and so would it be with the corresponding colouring of the seed-coats. According to the above assumption, each of these hybrid colour unions would be independent, and would consequently develop quite independently from the others. It is then easily seen that from the combination of the separate developmental series a perfect colour-series must result. If, for instance, $A = A_1 + A_2$ then the hybrids A_1a, and A_2a form the developmental series—

$$A_1 + 2A_1a + a$$
$$A_2 + 2A_2a + a$$

The members of this series can enter into nine different combinations, and each of these denotes another colour—

1 A_1A_2	2 A_1aA_2	1 A_2a
2 A_1A_2a	4 A_1aA_2a	2 A_2aa
1 A_1a	2 A_1aa	1 aa

The figures prescribed for the separate combinations also indicate how many plants with the corresponding colouring belong to the series. Since the total is sixteen, the whole of the colours are on the average distributed over each sixteen plants, but, as the series itself indicates, in unequal proportions.

Should the colour development really happen in this way, we could offer an explanation of the case above described, viz. that the white flowers and seed-coat colour only appeared once among thirty-one plants of the first generation. This colouring appears only once in the series, and could therefore also only be developed once in the average in each sixteen, and with three colour characters only once even in sixty-four plants.

It must, however, not be forgotten that the explanation here attempted is based on a mere hypothesis, only supported by the very imperfect result of the trial just described. It would, however, be well worth while to follow up the development of colour in hybrids by similar experiments, since it is probable that in this way we might learn the significance of the extraordinary variety in the colouring of our decorative flowers.

So far, little at present is known with certainty beyond the fact that the colour of the flowers in most ornamental plants is an extremely variable character. The opinion has often been expressed that the stability of the species is greatly disturbed or entirely upset by cultivation, and consequently there is an inclination to regard the development of cultivated forms as a matter of chance devoid of rules; the colouring of decorative plants is indeed usually cited as an example of great instability. It is, however, not clear why the simple transference into garden soil should result in such a thorough and persistent revolution in the plant organism. No one will seriously maintain that the development of plants in the open country is ruled by other laws than in the garden bed. Here, as there, changes of type must take place if the conditions of life be altered, and the species possesses the capacity of fitting itself to its new environment. It is willingly granted that by cultivation the origination of new varieties is favoured, and that by man's labour many varieties are acquired which, under natural conditions, would be lost; but nothing justifies the assumption that the tendency to the formation of varieties is so extraordinarily increased that the species speedily lose all stability, and their offspring diverge into an endless series of extremely variable forms. Were the change in the conditions of vegetation the sole cause of variability we might expect that those cultivated plants which are grown for centuries under almost identical conditions would again attain constancy. That, as is well known, is not the case, since it is precisely under such circumstances that not only the most varied but also the most variable forms are found. It is only the *Leguminosæ*, like *Pisum*, *Phaseolus*, *Lens*, whose organs of fertilisation are protected by the keel, which constitute a noteworthy exception. Even here there have arisen numerous varieties during a cultural period of more than 1,000 years; these maintain, however, under unchanging environments a stability as great as that of species growing wild.

It is more than probable that as regards the variability of cultivated plants there exists a factor which so far has received little attention. Various experiments force us to the conclusion that our cultivated plants,

with few exceptions, are *members of various hybrid series,* whose further development in conformity with law is changed and hindered by frequent crossings *inter se.* The circumstance must not be overlooked that cultivated plants are mostly grown in great numbers and close together, which affords the most favourable conditions for reciprocal fertilisation between the varieties present and the species itself. The probability of this is supported by the fact that among the great array of variable forms solitary examples are always found, which in one character or another remain constant, if only foreign influence be carefully excluded. These forms develop precisely as do those which are known to be members of the compound hybrid series. Also with the most susceptible of all characters, that of colour, it cannot escape the careful observer that in the separate forms the inclination to vary is displayed in very different degrees. Among plants which arise from *one* spontaneous fertilisation there are often some whose offspring vary widely in the constitution and arrangement of the colours, while others furnish forms of little deviation, and among a greater number solitary examples occur which transmit the colour of the flowers unchanged to their offspring. The cultivated species of *Dianthus* afford an instructive example of this. A white-flowered example of *Dianthus caryophyllus,* which itself was derived from a white-flowered variety, was shut up during its blooming period in a greenhouse; the numerous seeds obtained therefrom yielded plants entirely white-flowered like itself. A similar result was obtained from a subspecies, with red flowers somewhat flushed with violet, and one with flowers white, striped with red. Many others, on the other hand, which were similarly protected, yielded progeny which were more or less variously coloured and marked.

Whoever studies the colouration which results in decorative plants from similar fertilisation can hardly escape the conviction that here also the development follows a definite law which possibly finds its expression *in the combination of several independent colour characters.*

Concluding Remarks.

It can hardly fail to be of interest to compare the observations made regarding *Pisum* with the results arrived at by the two authorities in this branch of knowledge, Kölreuter and Gärtner, in their investigations. According to the opinion of both, the hybrids in outer appearance present either a form intermediate between the original species, or they closely resemble either the one or the other type, and sometimes can hardly be discriminated from it. From their seeds usually arise, if the fertilisation was effected by their own pollen, various forms which differ from the normal type. As a rule, the majority of individuals obtained by one fertilisation maintain the hybrid form, while some few others come more like the seed parent, and one or the other individual approaches the pollen parent. This, however, is not the case with all hybrids without exception. With some the offspring have more nearly approached, some the one and some the other, original stock, or they all incline more to one or the other side; while with others *they remain perfectly like the hybrid* and continue constant in their offspring. The hybrids of varieties behave like hybrids of species,

but they possess greater variability of form and a more pronounced tendency to revert to the original type.

With regard to the form of the hybrids and their development, as a rule an agreement with the observations made in *Pisum* is unmistakable. It is otherwise with the exceptional cases cited. Gärtner confesses even that the exact determination whether a form bears a greater resemblance to one or to the other of the two original species often involved great difficulty, so much depending upon the subjective point of view of the observer. Another circumstance could, however, contribute to render the results fluctuating and uncertain, despite the most careful observation and differentiation; for the experiments plants were mostly used which rank as good species and are differentiated by a large number of characters. In addition to the sharply defined characters, where it is a question of greater or less similarity, those characters must also be taken into account which are often difficult to define in words, but yet suffice, as every plant connoisseur knows, to give the forms a strange appearance. If it be accepted that the development of hybrids follows the law which is valid for *Pisum*, the series in each separate trial must embrace very many forms, since the number of the components, as is known, increases with the number of the differentiating characters in *cubic ratio*. With a relatively small number of trial-plants the result therefore could only be approximately right, and in single cases might fluctuate considerably. If, for instance, the two original stocks differ in seven characters, and 100 and 200 plants were raised from the seeds of their hybrids to determine the grade of relationship of the offspring, we can easily see how uncertain the decision must become, since for seven differentiating characters the developmental series contains 16,384 individuals under 2,187 various forms; now one and then another relationship could assert its predominance, just according as chance presented this or that form to the observer in a majority of instances.

If, furthermore, there appear among the differentiating characters at the same time dominant characters, which are transferred entire or nearly unchanged to the hybrids, then in the components of the developmental series that one of the two original stocks which possesses the majority of dominant characters must always be predominant. In the experiment described relative to *Pisum*, in which three kinds of differentiating characters were concerned, all the dominant characters belonged to the seed parent. Although the components of the series in their internal composition approach both original stock plants equally, in this trial the type of the seed parent obtained so great a preponderance that out of each sixty-four plants of the first generation fifty-four exactly resembled it, or only differed in one character. It is seen how rash it may be under such circumstances to draw from the external resemblances of hybrids conclusions as to their internal relations.

Gärtner mentions that in those cases where the development was regular among the offspring of the hybrids the two original species were not reproduced, but only a few closely approximating individuals. With very extended developmental series it could not in fact be otherwise. For seven differentiating characters, for instance, among more than 16,000 individuals—offspring of the hybrids—each of the two original species would

occur only once. It is therefore hardly possible that such should appear at all among a small number of trial plants; with some probability, however, we might reckon upon the appearance of a few forms which approach them in the series.

We meet with an essential difference in those hybrids which remain constant in their progeny and propagate themselves as truly as the pure species. According to Gärtner, to this class belong the remarkably fertile hybrids *Aquilegia atropurpurea canadensis*, *Lavatera pseudolbia thuringiaca*, *Geum urbano-rivale*, and some *Dianthus* hybrids; and, according to Wichura, the hybrids of the Willow species. For the history of the evolution of plants this circumstance is of special importance, since constant hybrids acquire the status of new species. The correctness of this is evidenced by most excellent observers, and cannot be doubted. Gärtner had opportunity to follow up *Dianthus Armeria deltoides* to the tenth generation, since it regularly propagated itself in the garden.

With *Pisum* it was shown by trials that the hybrids form egg and pollen cells of different kinds, and that herein lies the reason of the variability of their offspring. In other hybrids, likewise, whose offspring behave similarly we may assume a like cause; for those, on the other hand, which remain constant the assumption appears justifiable that their fertilising cells are all alike and agree with the foundation-cell of the hybrid. In the opinion of renowned physiologists, for the purpose of propagation one pollen cell and one egg cell unite in Phanerogams * into a single cell, which is capable by assimilation and formation of new cells to develop an independent organism. This development follows a constant law, which is founded on the material composition and arrangement of the elements which meet in the cell in a vivifying union. If the reproductive cells be of the same kind and agree with the foundation cell of the mother plant, then the development of the new individual will follow the same law which rules the mother plant. If it chance that an egg cell unites with a dissimilar pollen cell, we must then assume that between those elements of both cells, which determine the mutual differences, some sort of compromise is effected. The resulting compound cell becomes the foundation of the hybrid organism, the development of which necessarily follows a different law from that obtaining in each of the two original species. If the compromise be taken to be a complete one, in the sense, namely, that the hybrid embryo is formed from cells of like kind, in which the differences are entirely and permanently accommodated together, the further result follows that the hybrids, like any other stable plant species, remain true to themselves in their offspring. The reproductive cells which are formed

* In *Pisum* it is placed beyond doubt that for the formation of the new embryo a perfect union of the elements of both fertilising cells must take place. How could we otherwise explain that among the offspring of the hybrids both original types reappear in equal numbers and with all their peculiarities? If the influence of the egg cell upon the pollen cell were only external, if it fulfilled the *rôle* of a nurse only, then the result of each artificial fertilisation could be no other than that the developed hybrid should exactly resemble the pollen parent, or at any rate do so very closely. This the experiments so far have in no wise confirmed. An evident proof of the complete union of the contents of both cells is afforded by the experience gained on all sides that it is immaterial, as regards the form of the hybrid, which of the original species is the seed parent or which the pollen parent.

in their seed vessels and anthers are of one kind, and agree with the fundamental compound cell.

With regard to those hybrids whose progeny is variable we may perhaps assume that between the differentiating elements of the egg and pollen cells there also occurs a compromise, in so far that the formation of a cell as foundation of the hybrid becomes possible; but, nevertheless, the arrangement between the conflicting elements is only temporary and does not endure throughout the life of the hybrid plant. Since in the habit of the plant no changes are perceptible during the whole period of vegetation, we must further assume that it is only possible for the differentiating elements to liberate themselves from the enforced union when the fertilising cells are developed. In the formation of these cells all existing elements participate in an entirely free and equal arrangement, in which it is only the differentiating ones which mutually separate themselves. In this way the production would be rendered possible of as many sorts of egg and pollen cells as there are combinations possible of the formative elements.

The attribution attempted here of the essential difference in the development of hybrids to *a permanent or temporary union* of the differing cell elements can, of course, only claim the value of an hypothesis for which the lack of definite data offers a wide field. Some justification of the opinion expressed lies in the evidence afforded by *Pisum* that the behaviour of each pair of differentiating characters in hybrid union is independent of the other differences between the two original plants, and, further, that the hybrid produces just so many kinds of egg and pollen cells as there are possible constant combination forms. The differentiating characters of two plants can finally, however, only depend upon differences in the composition and grouping of the elements which exist in the fundamental cells of the same in vital interaction.

Even the validity of the law formulated for *Pisum* requires still to be confirmed, and a repetition of the more important experiments is consequently much to be desired, that, for instance, relating to the composition of the hybrid fertilising cells. A differential [factor] may easily escape the single observer, which although at the outset may appear to be unimportant, may yet accumulate to such an extent that it must not be ignored in the total result. Whether the variable hybrids of other plant species observe an entire agreement must also be first decided experimentally. In the meantime we may assume that in material points a difference in principle can scarcely occur, since the unity in the developmental plan of organic life is beyond question.

In conclusion, the experiments carried out by Kölreuter, Gärtner, and others with respect to *the transformation of one species into another by artificial fertilisation* merit special mention. A special importance has been attached to these experiments, and Gärtner reckons them among "the most difficult of all in hybridisation."

Should a species A be transformed into a species B, both would be united by fertilisation and the resulting hybrids then be fertilised with the pollen of B; then out of the various offspring resulting that form would be selected which stood in nearest relation to B and once more be fertilised with B pollen, and so continuously until finally a form was arrived at which was like B and constant in its progeny. By this process the

species A would change into the species B. Gärtner alone has effected thirty such trials with plants of genera *Aquilegia*, *Dianthus*, *Geum*, *Lavatera*, *Lychnis*, *Malva*, *Nicotiana*, and *Œnothera*. The period of transformation was not alike for all species. While with some a triple fertilisation sufficed, with others this had to be repeated five or six times, and even in the same species fluctuations were observed in various experiments. Gärtner ascribes this difference to the circumstance that "the typical force by which a species, during reproduction, effects the change and transformation of the maternal type varies considerably in different plants, and that, consequently, the periods must also vary within which the one species is changed into the other, as also the number of generations, so that the transformation in some species is perfected in more, and in others in fewer generations." Further, the same observer remarks "that in these transformation trials a good deal depends upon which type and which individual be chosen for further transformation."

If it may be assumed that in these trials the development of the forms resulted in a similar way to that of *Pisum*, the entire process of transformation would find a fairly simple explanation. The hybrid forms as many kinds of egg cells as there are constant combinations possible of the characters conjoined therein, and one of these is always of the same kind as the fertilising pollen cells. Consequently there always exists the possibility with all such trials that even from the second fertilisation there may result a constant form identical with that of the pollen parent. Whether this really be obtained depends in each separate case upon the number of the trial plants, as well as upon the number of differentiating characters which are united by the fertilisation. Let us, for instance, assume that the plants selected for trial differed in three characters, and the species ABC is to be transformed into the other species abc by repeated fertilisation with the pollen of the latter; the hybrids resulting from the first cross form eight different kinds of egg cells, viz.:

ABC, ABc, AbC, aBC, Abc, aBc, abC, abc.

These in the second trial year are united again with the pollen cells abc, and we obtain the series

AaBbCc + AaBbc + AabCc + aBbCc + Aabc + aBbc + abCc + abc.

Since the form abc occurs once in the series of eight components, it is consequently little likely that it would be missing among the trial plants, even were these raised in a smaller number, and the transformation would be perfected already by a second fertilisation. If by chance it did not appear, then the fertilisation must be repeated with one of those forms nearest akin, Aabc, aBbc, abCc. It is perceived that such an experiment must extend the farther *the smaller the number of trial plants and the larger the number of differentiating characters* in the two original species; and that, furthermore, in the same species there can easily occur a delay of one or even of two generations such as Gärtner observed. The transformation of widely divergent species could generally only be completed in five or six trial years, since the number of different egg cells which are formed in the hybrid increases in square ratio with the number of differentiating characters.

Gärtner found by repeated trials that the respective period of trans-

formation varies in many species, so that frequently a species A can be transformed into a species B a generation sooner than can species B into species A. He deduces thereform that Kölreuter's opinion can hardly be maintained that " the two natures in hybrids are perfectly in equilibrium." It appears, however, that Kölreuter does not merit this criticism, but that Gärtner rather has overlooked a material point, to which he himself elsewhere draws attention, viz. that " it depends which individual is chosen for further transformation." Experiments which in this connection were carried out with two species of *Pisum* demonstrated that as regards the choice of the fittest individuals for the purpose of further fertilisation it may make a great difference which of two species is transformed into the other. The two trial plants differed in five characters, while at the same time those of species A were all dominant and those of species B all recessive. For mutual transformation A was fertilised with pollen of B, and B with pollen of A, and this was repeated with both hybrids the following year. With the first trial $\frac{B}{A}$ there were eighty-seven plants available in the third trial year for the selections of individuals for further crossing, and these were of the possible thirty-two forms; with the second trial $\frac{A}{B}$ seventy-three plants resulted, which *agreed throughout perfectly in habit with the pollen parent*; in their internal composition, however, they must have been just as varied as the forms of the other trial. A definite selection was consequently only possible with the first trial; with the second some plants selected at random had to be excluded. Of the latter only a portion of the flowers were crossed with the A pollen, the others were left to fertilise themselves. Among each five plants which were selected in both trials for fertilisation there agreed, as the following year's culture showed, with the pollen parent :—

First Trial.	Second Trial.	
2 Plants	—	in all characters
3 "	—	" 4 "
—	2 plants	" 3 "
—	2 "	" 2 "
—	1 plant	" 1 character

In the first trial, therefore, the transformation was completed; in the second, which was not continued further, two more fertilisations would probably have been required.

Although the case may not frequently occur that the dominant characters belong exclusively to one or the other of the original parent plants, it will always make a difference which of the two possesses the majority. If the pollen parent shows the majority, then the selection of forms for further crossing will afford a less degree of security than in the reverse case, which must imply a delay in the period of transformation, provided that the trial is only considered as completed when a form is arrived at which not only exactly resembles the pollen plant in form, but also remains as constant in its progeny.

Gärtner, by the results of these transformation experiments, was led to oppose the opinion of those naturalists who dispute the stability of

plant species and believe in a continuous evolution of vegetation. He perceives in the complete transformation of one species into another an indubitable proof that species are fixed within limits beyond which they cannot change. Although this opinion cannot be unconditionally accepted we find on the other hand in Gartner's experiments a noteworthy confirmation of the supposition regarding variability of cultivated plants which has already been expressed.

Among the trial species there were cultivated plants, such as *Aquilegia atropurpurea* and *canadensis*, *Dianthus caryophyllus*, *chinensis*, and *japonicus*, *Nicotiana rustica* and *paniculata*, and hybrids between these species lost none of their stability after four or five generations.

ON WOAD AS A PREHISTORIC PIGMENT.

By Charles B. Plowright, M.D.

One of the first concrete facts of English history which a child learns at school is that the Ancient Britons dyed themselves blue with a plant called Woad. Since visiting a Woad farm in Cambridgeshire some years ago the question has constantly recurred to the writer, How did they do it? A pretty extended correspondence with those who in recent times have written on the subject, a perusal of most of the published books on it, from Ruellius's "De Natura Stirpium" (1536) to Professor Beijerinck's latest paper, epitomised in *Nature*, November 18, 1899, as well as a series of attempts to extract the blue colour from the plant itself, in order to find an answer to the above question, have afforded a considerable amount of occupation during the past six months, and yielded results some of which may be of interest to the readers of the Journal of the Royal Horticultural Society.

In the first place, Did the Ancient Britons really dye themselves blue? Cæsar* clearly says they did: "All the Britons stain themselves with Woad (*vitrum*), which produces a blue colour and gives them a more horrible appearance in battle." Pliny † says, however, "There is a plant like Plantain, called in Gaul *glastum*, with which the wives and daughters of the Britons smear their bodies in certain ceremonies and go naked, being of the colour of Ethiopians;" while Ovid ‡ speaks of our ancestors as *Virides Britannos*. Pomponius Mela § confirms Cæsar in the use of Woad by the Britons; he says, "They dye their bodies with Woad (*vitrum*), whether for ornament or any other reason is not known." Lastly, Herodian ‖ refers to the Ancient Britons as being ignorant of the use of clothes, but "They mark their bodies with various figures of all kinds of animals, which is the reason they wear no clothes for fear of hiding these figures."

Cæsar, Pliny and Mela, then, agree as to the use of Woad as a decorative pigment, but Cæsar says it was blue, Pliny that it was black, while Ovid, although not mentioning the exact substance, refers to our ancestors as "green," and Herodian intimates that they were tattooed. It is quite possible that each of these writers is more or less correct, for Woad will yield not only a blue pigment—which, however, is often more or less green—but even more easily yields a black one, as the hands of the Woad gatherers in autumn plainly show.

That the fact that Woad was capable of yielding a blue pigment was known to the ancients is evident from the remarks Pliny ¶ makes as to true indigo being adulterated by chalk and pigeon's dung stained with Woad. Coming nearer home, Sir Thomas Wardle informs me, in a letter on the subject, that he was present some years ago at the opening of a barrow at Sheen, near Hartington, in which a considerable amount of

* Cæsar, *De Bello Gallico*, book v. chap. 14.
† Pliny, *Nat. Hist.* xxii. 2.
‡ Ovid, *Amorum*, ii. 16, 39.
§ Pomponius Mela, ii. 1.
‖ Herodian, iii. 47.
¶ Pliny, *Nat. Hist.* xxxv. 6, 27.

woad-indigo was found, in lumps and powder, the sepulture being probably that of a dyer.

So completely has Woad as a dye been superseded by indigo in this country that its blue colour is now more or less legendary. Although still grown for the purpose of the dyer in various parts of Lincolnshire and Cambridgeshire,* no one connected with the industry could give me the slightest hint as to how the blue colour in it could be demonstrated.

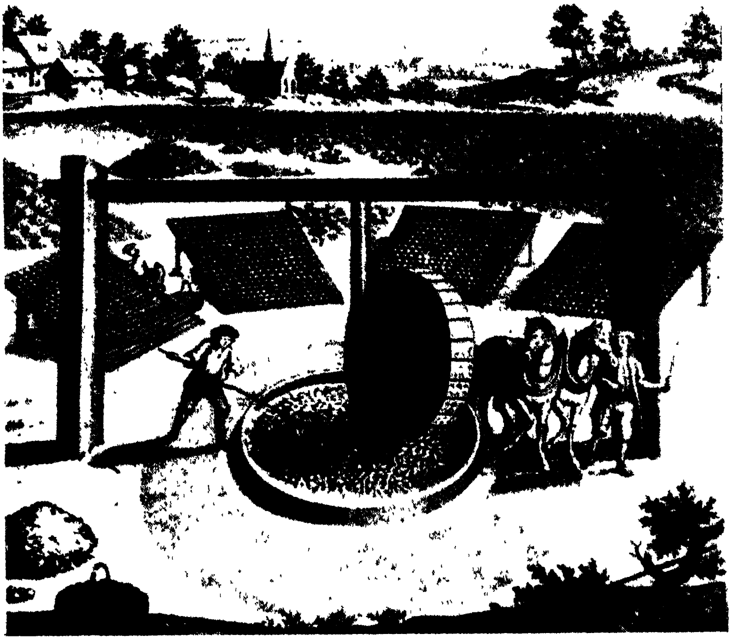


FIG. 1.—THURINGIAN WOAD MILL OF THE EIGHTEENTH CENTURY.

This engraving shows a field of Woad, with three figures kneeling in the distance gathering the Woad leaves. In the centre is a large millstone turned by a pair of horses, with the Woad-man raking the leaves under the millstone. Just behind are four racks or ranges; upon these the balls of Woad into which the crushed pulp is made are placed to dry. A heap of gathered Woad leaves is seen just behind these to the left. In the front of the picture, on the left, is shown a heap of crushed Woad and Woad balls, both in a basket and lying beside it. In the right-hand corner a Woad-spud is shown, having the same shaped blade, but with a different handle, to that in use in Cambridgeshire in the present day.—From Schreber's "Beschreibung des Waidtes," 1752.

One of the largest growers is the lineal descendant of a Woad-growing family of over one hundred years' standing, yet neither he nor any of his employés was able to help me in this particular.

The modern books of botany are silent on this point, while the dictionaries and encyclopædias are content with copying their predecessors

* Darwin, F., and Meldola, R., *Nature*, Nov. 12, 1896, p. 36.

in giving accounts of Woad manufacture, and stating that this plant was formerly used for dyeing cloth blue, but has now been superseded by indigo. Indigo was introduced into Europe as a commercial article in the sixteenth century, but Woad is still grown and manufactured in the above-named districts, so that although superseded by indigo as a dye, the manufacture of it is an industry which dies hard. Just one hundred years ago, when Arthur Young * visited Lincolnshire, its use was declining, and he speaks of it as if a few more growers would even then hopelessly swamp the market. In the tenacity with which this industry clings to life it resembles the moribund flint-knapping still carried on at Brandon, where one may even to-day watch the manufacture of gun flints. It is clear, then, that Woad still has a use in dyeing, but that use is *not* the yielding of a blue dye; in fact, it is its peculiar use which has caused its cœrulescent property to be lost sight of so completely. It is used for the purpose of *setting up a fermentation* in the indigo vat, whereby the indigo is rendered soluble. Curiously enough, this cumbersome and expensive mode of dyeing yields such excellent results that a "woaded cloth" has come to mean any particularly "fast cloth," whether it be dyed by Woad or not. These Woad vats are difficult to manage, but the articles dyed in them will stand rain and sunshine, salt spray and sea air better than any others. The Woad grower's aim is to produce an article containing the maximum amount of fermentable material, regardless of the quantity of colouring matter. But it was not always so. During the early part of the nineteenth century there still survived a proverbial saying in East Anglia which can yet be remembered by the older generation, based on the colouring property of Woad, viz. to speak of an object being "As blue as Wad." In France, during the long war which terminated at the battle of Waterloo, so great was the difficulty experienced in getting indigo into the country that the Government offered a substantial reward for the discovery of any blue dye capable of being produced in the climate of Europe, and which would prove an effective substitute for indigo. Attention was naturally directed to Woad, and various treatises upon its culture and the best methods of extracting indigo from it appeared. In one of these Giobert,† a professor of chemistry at Turin, gives several methods for its extraction. From the tone in which he writes one would conclude this to be a very simple matter. However satisfactory these processes may have been in France and Italy, they have not proved so in my hands. Indeed, after many trials, I came to the conclusion that indigo was now absent from our Woad. In 1855 Dr. E. Schunck showed that indigo does not exist as such in Woad, neither as the soluble indigo-white ($C_{16}H_{12}N_2O_2$), nor the insoluble indigo-blue ($C_{16}H_{14}N_2O_2$), but that it was produced by the oxidation of a peculiar body to which he applied the name of indican ($C_{26}H_{31}NO_{17}$). Indican can be extracted from Woad by various more or less complicated processes, of which the details are given in Dr. Schunck's paper.‡ It is a very unstable body, which by the action of acids passes into indigo-blue.

* Young, Arthur, *A General View of the Agriculture of Lincolnshire*, 8vo. 1799.

† Giobert, M., *Traité sur le Pastel*, Paris, 1813; De Puymaurin *Sur le Pastel, sa Culture, et les Moyens d'en retirer l'Indigo*, 1810.

‡ Schunck, Dr., "On the Formation of Indigo-Blue," *Philosophical Magazine*, Aug. 1855, vol. x. p. 73.

In 1887 M. Alvarez * attributed the formation of indigo to microbic action. In the case of *Indigofera tinctoria* the organism in question consists of a bacillus 3 × 1·5 mm., rounded at the ends, in chains of from 6 to 8, surrounded by a gelatinous envelope. In old cultures the bacilli are very motile, but less so in recent ones. They resemble the microbes of Rhinoscleroma and the Pneumococcus of Friedländer, both of which organisms Alvarez asserts are capable of setting up indigo fermentation. In 1898 Bréaudat † showed that with *Isatis alpina* micro-organisms played no part in the formation of indigo, because the change took place in weakly alkalised chloroform water, as well as in water containing volatile oil of mustard. He considered that the leaves contained a hydrated diastase and an oxydase, the former of which in the presence of water reduces the indican to indiglucine and indigo-white. The indigo-white is transformed by the oxydase into indigo-blue in the presence of an alkali.

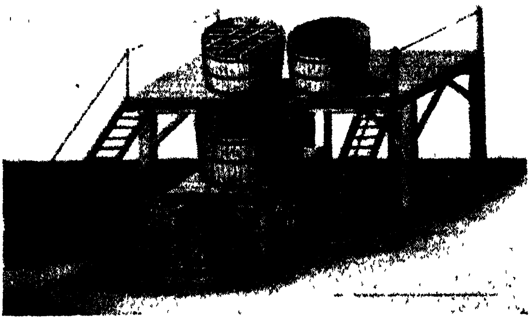


FIG. 2.

Apparatus devised by Heinrich for the extraction of indigo from Woad. The two upper tubs are to contain, one, Woad leaves, which were first allowed to become slightly dry, and water; the splines seen on the top of the tub are to keep the Woad leaves under water. The other tub is to contain quicklime and water to form lime-water. After macerating some hours the contents of both these tubs were allowed to run into the large tub in the centre of the picture. Here the liquids were mixed and aërated by being allowed to run into the small tub in front and below, from which they were raised by a small hand-pump as shown in the figure. At the end of the process the precipitated indigo was drawn off by opening the taps at the sides of the large middle tub.—From J. B. Heinrich's *Cultur des Waids und die Indigoberichtung aus dieselben.* Wien, 1812. [For the opportunity of seeing this book my thanks are due to Dr. Hans Molisch.]

During the past summer a series of attempts to obtain indigo by immersing crushed Woad leaves in weakly alkalised water after the manner recommended by Bréaudat have been unsuccessful. The Woad leaves were obtained from Woad cultivated in Lincolnshire and in Cambridgeshire, from the Cambridge Botanic Gardens and from wild plants from Gloucestershire. The result was, however, the same: not a trace of blue colour would they, any of them, yield. A single exception is, however, noteworthy. One plant from near Boston, put in water by itself, in a glass specimen tube, turned blue without any special treatment; many

* *Compte-Rendu Acad. des Sciences*, 1er août 1887, t. 105, p. 287.

† Bréaudat, L., "Sur le Mode de Formation de l'Indigo," *Annales d'Hygiène et de Médecine coloniales*, vol. i. 1898, No. 4, Oct.-Nov., p. 525.

other leaves were brought home at the same time from the same place, but they all passed into putrefaction without showing any trace of blue. Professor Marshall Ward shortly after this drew my attention to a paper which had just been published by Dr. Hans Molisch * in which he gives a very simple method of demonstrating the presence of indigo in these plants. It consists in simply keeping the fresh leaves in a closed vessel filled with ammonia gas for twenty-four hours and then transferring them for twenty-four hours into absolute alcohol. The ammonia causes the indigo to turn blue, in which state it is insoluble in the alcohol, while the last-named substance dissolves out the chlorophyl, so that when the leaves are sectioned and mounted in balsam one can see not only that indigo is present, but also the exact tissues in which it occurs, viz. in the chlorophyl-bearing tissues, being absent from the cuticle, the hairs and fibro-vascular bundles. Herr Molisch, in a letter to me, advised me to examine by this method the very youngest leaves, such for instance as were not more than an inch long. By doing this the presence of indigo in the Parson Drove Woad was easily demonstrated, and it became equally

FIG. 3.

Woad Spud used at Parson Drove, and in the Fen-land generally, for weeding Woad. This process is done by men and women kneeling. The handle is cut with a crutch to fit the hand, and is generally made either of Willow or Hawthorn. The spud figured was in use in a Woad field at Parson Drove in 1899; its cutting edge showed signs of wear.

apparent that the fully-grown leaves were late in the year practically devoid of it. Such a leaf came out of the absolute alcohol a brittle, yellowish-white object, while the growing leaves were distinctly blue.

Marchlewski and Radcliffe † considered that indican consisted of sugar and indoxyl, the latter being a very unstable substance (C_8H_7NO). Professor Beijerinck ‡ has recently controverted Bréaudat's assertion of the presence of an oxydase in Woad. He considers the indigo-producing plants constitute two groups, one containing indican, such as *Indigofera tinctoria*, *Polygonum tinctorum*, &c., which yield a solution of indican when treated with hot water, but if they be immersed in water below 50° C. and the air excluded will yield an indoxyl solution; the presence of an enzyme whose action is destroyed by the higher temperature being the

* Molisch, H., "Ueber das Vorkommen von Indican in Chlorophyllkorn der Indicanpflanzen," *Berichte der Deutschen Botan. Gesell.* 1899, Bd. xvii. Hf. 6, p. 228, t. xviii.

† *Journal of the Society of Chemical Industry*, May 31, 1898, p. 430.

‡ Beijerinck, M. W., "On the Formation of Indigo from Woad," *Koninklijke Akademie van Wetenschappen te Amsterdam*, Oct. 25, 1899.

cause of this. If these plants be treated with boiling water the enzyme is destroyed and indican solution is obtained, which, if microbes be excluded, will keep undecomposed; but the addition of this indigo enzyme and certain yeasts, as well as boiling with acids, convert it into indoxyl and sugar.

Woad, on the other hand, is an indoxyl plant which always yields an indoxyl solution either to hot or cold water, but it is necessary to keep the air excluded, as this indoxyl is so easily oxidised and the indigo-blue lost. For the extraction of indoxyl, he recommends that a wide-mouthed stoppered bottle be filled with Woad leaves and hot water poured in, the leaves are then pressed down so that all the air is expelled and the stopper put in, in such a manner that no air bubble is left between the top of that water and the stopper. In the course of a few hours a clear pale yellow liquid can be decanted which is rich in indoxyl; the addition of an alkali and blowing through the liquid causes the precipitation of indigo-blue. The addition of one of the stronger acids, in a diluted state, acts, however, more rapidly than the carbonic anhydride. The infusion is yellow with a green fluorescence. The result of this experiment with Parson Drove Woad was eminently successful, the infusion was beautifully fluorescent; by transmitted light it was pale sherry coloured, but pale green by reflected light. On the addition of an alkali it turned greenish yellow, and when a few drops of dilute hydrochloric acid were let fall into it an abundant precipitate of the long-looked-for indigo-blue took place. So that after all the extraction of the blue colour of Woad is absurdly simple, if one knows how to do it and goes the right way to work! One must, however, be very careful in several particulars, or instead of a blue, a black precipitate will result. In the first place the Woad leaves must be fresh; in the second place they must be young, or rather they must be actively growing. It is useless to manipulate old leaves. In English Woad culture, the details of which are given in Mr. Darwin's paper previously referred to, and even more fully in that by Mr. Corder* (together with much other highly interesting information), the method of gathering the crop consists in wrenching off the leaves by a grasp of the hand, so that not only the old but a few of the growing leaves are included; hence an infusion of the cropped plant yields more or less indigo, although if a larger percentage be desired only the youngest leaves must be used. Then, as to the temperature of the water; I find that not quite boiling answers best, say about 80°-90° C. There is no need to follow the elaborate details of excluding the air entirely, but if the nearly boiling water be poured on the leaves so that they are quite covered by it, the result will be perfectly satisfactory—provided the infusion be not left too long. Half an hour to five or six hours is quite long enough: after that you get the annoying black deposit which is the *bête noire* of the Woad experimenter. If the water be left some hours on the leaves it acquires a reddish tinge. The infusion is best when it is a pale yellow as above described. If to this be added, when it is *cold* but before it has stood too long, an alkali, either lime-water or caustic potash or soda or ammonia, the fluid becomes darker and greenish. Any woollen

* Corder, E., "On the Culture and Preparation of Woad at Parson Drove," *Transactions of the Norfolk and Norwich Naturalists' Society*, vol. v. 1890, pp. 144-156.

article now dipped into it turns distinctly green, and when exposed to the air the greenish shade passes into a pale azure blue. The immersion of the fabric in dilute hydrochloric or any other acid brings about this change at once. The colours which different articles assumed after dyeing varied from pale blue, blue, greenish blue, pale green, to various shades of bluish grey and dove colour. Potash, soda, and ammonia are pretty uniform in their action. Lime-water gives rise to a more bulky precipitate of a green hue, which after treatment with an acid does not apparently produce so pure a blue. The behaviour of different infusions varies, however, very remarkably, even when treated as nearly as possible in the same manner. One infusion, treated with lime-water and not acidulated, gave, after standing a few days, the most beautiful azure blue; but generally lime-water precipitates remained more or less green at the end of several days. One lot of caustic potash precipitates, left twelve hours before being acidulated, gave nothing but the brownish-black precipitate, which, whatever it may be, is not indigo.

In order to form some idea of the time the infusion should be left to extract the maximum quantity of indigo, an ordinary pint pharmaceutical infusion pot was filled with Woad leaves, which were covered with boiling water and weighted down. In half an hour 30 c.c. was poured off, cooled, alkalised with a few drops of caustic potash, and then rendered acid by dilute hydrochloric acid; this yielded ·041 gramme of good indigo blue. A series of similar trials gave the following results. —

Time infused	Colour of precipitate	Weight after drying at 100° C	Colour of dry precipitate
30 minutes	Good blue	·041 grm.	Blue
1½ hours	Blue tinged with green	·010 „	„
2 „	„	·013 „	„
3 „	More distinctly green	·040 „	Blue-black
6 „	Quite green	·030 „	Dirty black
9 „	„	·010 „	Black-brown
12 „	Green with some brown	·016 „	„
24 „	Dirty brown	·016 „	„
48 „	„	·015 „	„

It must not be supposed that the blue colour is always replaced by the black at the end of three or even six hours, but one cannot avoid the suspicion that some of the sanguine experimenters in bygone days, who wished to find an abundance of easily separated indigo in this plant, may have considered every dark precipitate indigo. No explanation is offered as to the variation in the quantities of the above trials beyond that the quantities taken were too small to give very reliable results; but it was obvious to the eye before the precipitates were weighed that these discrepancies did exist. The colours of the precipitates are those given by the gentleman who kindly weighed them for me, Mr. E. C. Trufitt.

With regard to the influence of the age of the leaves on the quantity of indigo they yield, the following results were obtained. The age of the leaves was a comparatively easy matter to determine, because the date of the last cropping was known. The sample examined on December 2, 1899, which yielded the most indigo, was the third cropping, that is to say, the leaves had been pulled off twice; under ordinary circumstances

these plants were considered over and done with, yet they yielded the greatest amount of indigo. In this instance the whole of the tops of the plants, down to, and including, the crown, were cut off, so that young and unexpanded leaves as well as rapidly growing leaves formed a considerable part of the sample.

INDIGO YIELDED BY ½ KILOGRAMME OF FRESH WOAD LEAVES.

Date of gathering	Age of leaves	No. of times cropped	Indigo, in grammes	Per cent.
22 November	28 days	Twice	1·500	·30
2 December	30 „	Three times	2·446	·48
22 November	34 „	Twice	2·113	·42
„ „	66 „	Twice	0·615	·12

To return to our ancestors.

(1) They may have dyed themselves blue by infusing fresh young Woad leaves in hot water, adding pearl ash or wood ashes, and washing themselves with the liquid.

(2) By substituting an excess of lime-water or by slaking quicklime in the infusion, they might have dyed themselves a green colour.

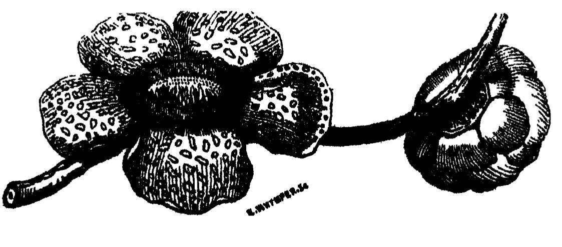
(3) By rubbing themselves with the juice of the plant they would have dyed themselves as black as the "wadmen" still dye their hands every autumn when cropping and balling the Woad.

(4) By infusing the plant, adding a small quantity of lime water, and drying the precipitate they could have obtained nearly pure indigo with which (*a*) they could have tattooed themselves, or (*b*) smeared it on their bodies, mixed with oil.

(5) It is most likely, however, that they obtained woad-indigo and used it for tattooing their bodies from the scum which rises to the top of the vessel in which the process of Woad dyeing is being successfully carried on. This was probably the source from which Pliny's chalk was stained blue, as it was that from which the missal illuminators of mediæval times—the *pictori* that Ruellius * speaks of—obtained their beautiful blue pigment. The interesting questions of Woad preparation and Woad dyeing must be left to another occasion.

My thanks are due to many friends for their help, but especially to Mr. Fitzalan Howard, Dr. E. Schunck, Dr. Hans Molisch, Professor Beijerinck, Professor O. Penzig, Mr. R. H. Biffen, Sir Thomas Wardle, Miss Annie Lorrain Smith, and Miss S. J. V. Dodds, in addition to those previously mentioned.

* Ruellius, J., *De Natura Stirpium*, Paris, 1536, lib. ii. cap. cxv. p. 574.



A SNOWDROP DISEASE.

By Geo. Massee, F.L.S.

The disease under consideration was first described by Berkeley and Broome in 1873* under the name of *Polyactis galanthina*, and stated to be "very destructive to Snowdrops." At a later period it was again recorded as a destructive parasite on Snowdrops by Worth. G. Smith,† who adds that the disease of Tulips and *Hevea* are caused by the same fungus. The disease of Snowdrops is still with us, and, as we consider, is due to the presence of the old and well-known fungus called *Botrytis cinerea* by Persoon, which is stated by De Bary to be the conidial form of the Peziza-like fungus now called *Sclerotinia Fuckeliana*.

The young leaves and flowers of the Snowdrop are attacked by the fungus just below the surface of the soil, and by the time they emerge above ground are much distorted and covered with a dense brownish mould. This development often occurs when the ground is covered with snow. Leaves and flowers thus attacked soon fall to the ground and decay, the bulb in many instances being also reduced to a soft pulp by the mycelium of the fungus.

If a Snowdrop leaf infested with the fungus is placed in a nutrient solution, such as a decoction of dung or plum juice mixed with gelatine, its surface and margin soon become studded with minute blackish grains. These grains are concentrated masses of the mycelium of the fungus, called sclerotia, which continue to increase in size for some time and assume various shapes, often growing into each other and forming a black continuous crust. At the same time the mycelium of the fungus present in the leaf spreads into the nutrient medium and in turn forms sclerotia, so that in course of time hundreds of these bodies are produced by a single diseased leaf. After a time the formation of sclerotia ceases, and no further change takes place until the following spring, when the sclerotia produce a crop of conidia or give origin directly to mycelium, depending on their relative position in the nutritive solution.

Now the formation of sclerotia as described above is exactly what takes place under natural conditions: the diseased Snowdrop leaves fall to the ground, where they form sclerotia; the mycelium present in the leaves also spreads into the soil and there forms more sclerotia, which remain unchanged until the following spring, when those sclerotia that happen to lie on the surface produce a crop of conidia, which germinate at once and form a copious weft of mycelium that spreads in the soil, obtaining its food from the humus present, and finally attacks the young leaves of the Snowdrop as they emerge from the ground. Those sclerotia that are buried in the soil or attached to a bulb do not bear conidia, but give origin directly to mycelium, which behaves as already described.

Numerous experiments have proved that the leaves cannot be infected by wind-borne conidia alighting on their surface; when conidia are placed

* *Ann. Nat. Hist.* 1873, p. 346, pl. viii. f. 8. † *Gard. Chron.* 1889, p. 275, fig. 49.

on the damp surface of a leaf they germinate readily, and the germ-tubes may even pierce the epidermis, but infection does not follow; whereas when the germ-tubes have formed a vigorous mycelium in a nutrient solution or in soil infection is certain.

A series of Snowdrop bulbs were placed in suitable glass vessels so arranged as to prevent the entrance of spores, and covered with sterilised soil; when the young leaves just appeared above the surface of the soil a sufficient quantity of a nutrient solution of plum juice in gelatine was added to reach about a quarter of an inch above the surface of the soil. In one of these vessels conidia were sown on the surface of the nutrient solution, and to another a quantity of vigorous mycelium formed by conidia sown in a nutritive solution ten days previously was added.

A certain number of leaves were removed daily for microscopic examination after the introduction of the conidia and mycelium, and it was found that in the vessel where conidia were placed ten days elapsed before the mycelium attacked the leaves; whereas in the vessel where the vigorously growing mycelium was deposited the leaves were attacked on the third day. The above are the average results obtained from a series of experiments extending over four years, and, it may be added, do not demonstrate new facts, but simply corroborate the observations of De Bary, who has already shown that the mycelium of certain species of *Botrytis* can only attack living tissues after living for some time as a saprophyte.

Experiments have shown that Snowdrops can be attacked at any age by the *Botrytis*, but when the leaves are full-grown the mycelium can only gain an entrance into the tissues below the surface of the soil. This is effected by mycelium produced by conidia that have been carried by wind from other diseased plants growing in the neighbourhood.

When a leaf is once attacked the mycelium spreads in its tissues very quickly, but I have never been able to trace the passage of the mycelium down the leaves into the bulb, although I have repeatedly succeeded in producing a rich growth of sclerotia on the bulb by bringing the latter into contact with actively growing mycelium, and I am inclined to believe that as a rule—if not always—sclerotia on the bulbs are formed from mycelium present in the soil.

The mycelium formed by sclerotia present on the bulb scales does not pass directly from the scales into the leaves, but spreads upwards through the soil, where it lives for some time, finally attacking the young leaves just below the surface of the soil. Bulbs attacked by sclerotia when grown in a glass vessel in a nutrient solution show this method of leaf-infection very clearly, as the moment a hypha pierces the tissue of a young leaf a minute brown spot appears, which continues to increase in size as the mycelium spreads in the tissues.

When *Botrytis* conidia are sown in a nutrient solution germination usually commences in about twenty hours; the number of germ-tubes produced by a conidium varies from one to four, these branch copiously, the branches often growing into each other and forming an irregular net-work. The branches belonging to two or more neighbouring conidia also often anastomose (6, fig. 4). After the culture has been growing for about three days numerous densely tufted branches of hyphæ, or organs of attachment, are formed (7, fig. 4). In one single instance conidia in a

hanging drop of a decoction of dung produced in the course of five days, in addition to a copious development of organs of attachment, several tufted short conical branches, each branch bearing a chain of globose colourless bodies at its apex resembling conidia in appearance; but these bodies will not germinate, and their function is problematical (8, fig. 4). These peculiar bodies are described as follows by Woronin,* "kleinen, spermatienahnlichen, unkeimfähigen, perlenartigen Sporidien," who considers them as very characteristic of the species of *Sclerotinia*.

So far as my experience goes *Botrytis* conidia will not germinate in tap-water containing one per cent. of cane sugar, and germination in tap-water alone is very tardy and weak.

A parasite called *Botrytis parasitica*, Cav., absolutely indistinguishable morphologically from the *Botrytis* attacking the Snowdrop, occurs as a destructive parasite on Tulips, and the general account given above applies in every detail to this Tulip parasite. Here, however, the resemblance ends, and physiologically the two are quite distinct.

When a mixture of Tulip and Snowdrop bulbs is planted in soil in a glass vessel as described above, and vigorous mycelium produced by conidia of the Snowdrop parasite is placed in the nutritive solution, the Snowdrops are only attacked; whereas when mycelium produced by conidia from a diseased Tulip is introduced it only attacks the Tulip leaves. In some instances the conidia for the above experiment were obtained directly from diseased plants, in others the conidia came from sclerotia that had formed in a nutrient solution and had been kept until the spring following their formation.

Now if it is considered imperative that species should be founded on morphological characters, as personally I think they should, it follows that the parasites attacking Snowdrops and Tulips respectively constitute one and the same species, and we must consider the two parasites as physiologically differentiated forms of the same species. Further experiments will probably demonstrate that such physiological races of a common species of *Botrytis* are much more numerous than is at present suspected.

Wakker, who investigated a Hyacinth disease caused by a *Botrytis*,† found on experimenting that onions could not be inoculated by the conidia of the Hyacinth *Botrytis*.

Saccardo‡ enumerates 140 species of *Botrytis*, characterised by measurements of the conidia, and more especially by the host they grow upon; but it is very probable, at least in the subgenus *Polyactis*, to which most of the destructive forms belong, that the majority will eventually be proved to be nothing more than physiologically differentiated forms or races of *Botrytis cinerea*, Pers.

Those who have had experience know perfectly well that when a *Botrytis* is grown artificially in different media, and under varied conditions as to temperature, density of culture medium, &c., the general habit, and size and form of the conidia vary to a much greater extent than would be required for the establishment of a new species, judged from the standpoint of specific characters as given by Saccardo.

* *Mém. de l'Acad. Sci. de St. Pétersb.* viii. sér., vol. x., 1900, p. 22.
† *Archiv. Néerlandaises*, xxiii. ‡ *Syll. Fung.* iv.

Kissling* states that not only is the general aspect and size of *Botrytis* modified by the particular substratum on which it is grown, but that the functional activity of the conidia is also affected. The last-named author gives an excellent *résumé* of what has been done with the parasitic species of *Botrytis* and *Sclerotinia*.

Botrytis cinerea, Pers., is exceedingly common as a saprophyte on decaying vegetable matter, and it has been proved possible to educate, as it were, by a series of cultures these wild saprophytic forms to become true parasites; in fact, the members of the *Polyactis* section of *Botrytis* appear to be capable of living as saprophytes or parasites depending on circumstances, thus coming under De Bary's category of facultative parasites. This power differs in degree in different species. Bearing on this point Marshall Ward, in his admirable study "A Lily Disease,"† states: "Accepting De Bary's results with *Peziza sclerotiorum*, I regard his fungus as a form physiologically midway between the ordinary *saprophytic Pezizas*, and my *parasitic* one; in other words, De Bary's fungus is in process of *being educated to parasitic habits!*"

I have observed that the excrementa of minute insects which so frequently abound amongst patches of mould often consists almost entirely of *Botrytis* conidia, and that many of these conidia germinate readily and produce a mycelium quite as vigorous as that formed by conidia that have not undergone such an ordeal. It is quite probable that these minute creatures may in a measure assist in the diffusion of the fungus.

No trace of an ascigerous condition of the *Botrytis* has been observed during numerous experiments extending over five years, although hundreds of sclerotia developing and hybernating under very varied conditions have been constantly under observation. If there is, in reality, a genetic relationship between *Botrytis* and *Sclerotinia* it must be very slender indeed at the present day. As already stated, De Bary is responsible for this idea, but perhaps he only intended the bald statement, unsupported by any account of direct cultural experiments as was his wont when such evidence existed, as a suggestion rather than as a proved fact. Soraeur‡ and Frank § also furnish circumstantial evidence as to the relationship between *Botrytis* and *Sclerotinia*, but the crucial test, which once for all would settle what appears to be as yet an open question, the production by means of pure cultures of the *Sclerotinia* form from a *Botrytis* conidium, and the converse, remains yet to be accomplished. The consecutive appearance of *Botrytis* and *Sclerotinia* in large masses of tissue is suggestive but not convincing. It is somewhat significant that where an undoubted genetic relationship between *Sclerotinia* and a conidial form has been demonstrated, as by Woronin, || the conidial form is not a *Botrytis*.

Smith,¶ an American mycologist, after years of investigation, has come to the conclusion that *Botrytis* and *Sclerotinia* are not phases of the same species, but that they are entities respectively, agreeing in producing sclerotia similar in appearance and structure; and furthermore, both under

* *Hedwigia*, 1889, p. 227. † *Ann. Bot.* ii. 1888, p. 319.
‡ *Handb. der Pflanzenkr.* ii. p. 249. § *Die Krankheiten der Pflanzen*, p. 530.
|| *Mém. Acad. Imp. St. Pétersbourg*, ser. vii. vol. xxxvi. 1888.
¶ *Bot. Gaz.* xix. p. 369 (1900).

certain conditions become true parasites, and not unfrequently appear on the same host-plant.

Practical Measures.

To cure a diseased plant is an impossibility, as from the moment of

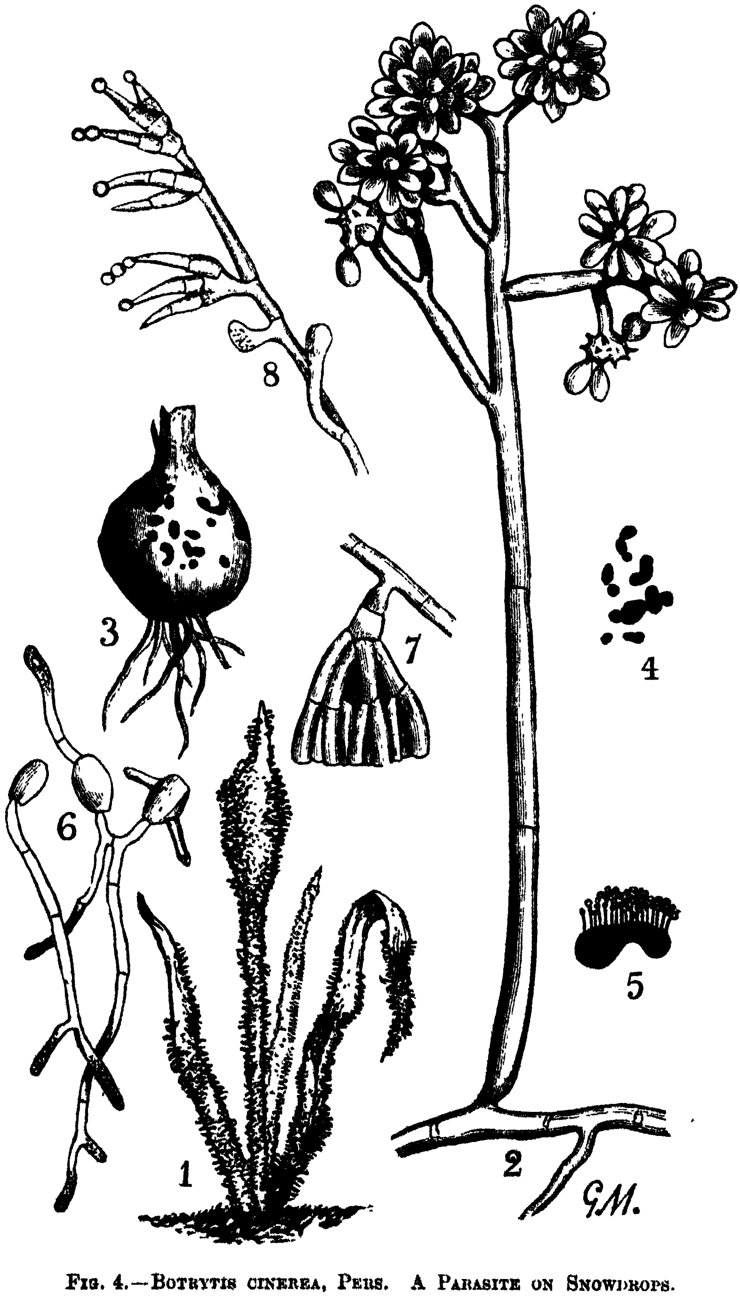


Fig. 4.—Botrytis cinerea, Pers. A Parasite on Snowdrops.

infection the mycelium of the fungus is safely lodged in the tissues of the host-plant, and no means are known, nor at all like'y to be discovered, of killing such mycelium without at the same time killing the portion of the plant containing it.

The important point to remember in attempting preventive measures, is the fact that the conidia cannot directly infect a Snowdrop leaf, but that inoculation can only be effected by mycelium that has been growing for some time in the soil. Such mycelium originates from sclerotia that have passed the winter in the soil; consequently, if the soil overlaying Snowdrops is removed during the winter, and fresh uninfected soil added, the danger of infection is reduced.

If the newly-added soil is mixed with lime– assuming this to be practicable—the mycelium originating from sclerotia attached to bulbs would be checked.

It is the manure and humus in the soil that alone furnishes the mycelium with food and enables it to become sufficiently vigorous to infest the Snowdrop leaves and bulbs. An ideal soil, in which the mycelium could not grow, should contain no organic matter, the necessary plant-food being furnished by artificial fertilisers. Such a condition may not be quite practical; nevertheless, the ideal should be aimed at as far as possible. Do not use manure, and change the surface soil during the winter.

DESCRIPTION OF FIGURE 4.

1. A young Snowdrop badly diseased; natural size.
2. Fruiting branch of the *Botrytis*; × 350.
3. A Snowdrop bulb with sclerotia; natural size.
4. Isolated sclerotia; natural size.
5. A sclerotium bearing a crop of *Botrytis*; × 10.
6. *Botrytis* conidia germinating; × 400.
7. One of the organs of attachment formed on the mycelium of *Botrytis*; × 400.
8. Chains of colourless conidia-like bodies produced at the tips of special short branches of the mycelium of *Botrytis*; × 400.

SOME TALK ABOUT WILD GARDENS.

By H. Selfe Leonard, F.R.H.S.

When I somewhat hastily acceded to a request that I would write a paper about the Wild Garden, I had not in mind the fact that Mr. Robinson had long ago published a short, but too neglected, book upon the subject. Had I had that book in mind I should not probably have thus agreed. However, there is perhaps left unfilled a corner of the subject; and for the rest, I shall not be ill employed in introducing to those to whom the subject may be new, the thoughts and the message of Mr. Robinson and his school.

The term "wild garden" is clearly one with different meanings for different persons.

To one it means a beautiful and wholly natural wildness, unplanted and untouched by man, a mere piece of nature in fact. To another, a garden or planting of purely *native* plants or wild flowers, as distinct from exotics. To a third, a wilderness, or waste place, within a garden, but studiously unkempt and uncared for. To Mr. Robinson himself it seems, if I mistake not, to mean a whole estate or extensive pleasure ground, planted as naturally and informally as may be with hardy exotic plants, in such fashion that the plants are left to grow pretty much as they will.

To me the term has generally meant not quite either of these things. My notion of a wild garden differs somewhat from Mr. Robinson's in this, that while he seemingly thinks of it as comprising the whole garden, even the whole estate, and the transforming of these by natural planting, I have thought of it more often as but a part of, or as an incident in, the garden or the estate; that while he thinks of it as a re-modelling of a place already formally planted, I think of it more as the creation of a wholly fresh and detached piece of natural garden beauty. I am not the least concerned to argue that my use of the term is more proper or exact than his, nor do I care how that may be.

But, at all events, by the term "wild garden" in this paper I mean, a certain extent of ground within an estate or within a garden, furnished both with native and with hardy exotic plants, shrubs, or conifers, beautiful in flower or in leaf, in such fashion that they may grow practically unrestrained, and with the minimum of future aid from art.

It will be obvious that in arranging such a planting we shall need to regard those just principles of natural gardening, which Mr. Robinson and his school have in these latter days expounded, as much as if our purpose were, like his, to reform a whole estate or a whole garden already existing. Both on this ground therefore, as also for their inherent value, let me remind you in summary of some of his essential teachings. With these, I may say once for all, I am generally in thorough agreement.

"Away" (he says in substance) "from our gardens, with bedding-out and trim flower borders, with the yearly digging and forking of shrubberies,

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FIG. 5.—A PORTION OF MR. G. F. WILSON'S WATER GARDEN AT WISLEY.

with tender exotics, and with conceits in clipped and sculptured trees, with bare soil surfaces, and with obtrusive artificial supports, whether for climber or for herbaceous plant.

"Fill your gardens with the wood and brake flora of the whole northern world, with the Alpines which cushion under the snow in whatever latitude winter snow may be found. Fill your woodlands with bluebells of all colours, if they be not full already, with foxgloves, and anemones and brambles, and daffodils, and forget-me-nots and primroses, with night-blooming œnotheras and what-not, in quantity and mass, as if the hand of man had not planted them there. Drape your hedgerows and your dead trees and your coverts with clematis, and honeysuckles, and peaflowers, and vines, and bind-weeds, and single roses. Plant and sow your walls with linarias, and antirrhinums, and erinus, and harebells, and saxifrages and ferns, and all else that will naturally grow there. Cover your bare banks with natural tangles and with falling creepers, and the banks of your ponds and streams with iris and marsh marigold and water-dock and loose-strife, and your meadows and the skirts of your woodlands with daffodils and colchicums.

"And when you have finished the natural planting of the spaces without the garden proper, and finally enter *it*, set yourself so to lay out and to plant *it* that it may blend insensibly with surrounding nature. Let its borders be, or be made, only natural in outline, their surfaces wholly filled, even crowded, as in nature, with carpeting vegetation, and let their nobler occupants be naturally grouped, naturally set, for contrast or for harmony."

That, or something like that, is the teaching of the natural school of gardening, so far as essential to my present purpose. I readily yield my own assent to it "in the broad," although circumstances of many kinds prevent most of us from acting up to this ideal in all our gardening operations. For the bit of formal bedding, or the hard line of path or border still often lingers, even in the garden of the faithful, long after his conversion. Such inconsistencies are generally remnants of old times, left, like much else in our lives, not because we like them or think well of them, but as concessions to that past from which we break but slowly, to the conservatism of Madame, or may be of an "old time" gardener.

And of the general teaching of this "natural school" in gardening, wild gardening on the lines which I have outlined is perhaps the most essential and most characteristic feature.

A recent and very competent writer in the *Garden* newspaper, advising a correspondent upon the planting as a wild garden of a "thin eight acre wood" in Cornwall, counsels the using of a very limited number of kinds of Conifers, and to "keep the main sheltering growth as simple as possible"; and expresses preference for this purpose for English Yew and green Holly, *Pinus insignis* and *Cupressus macrocarpa.*

According to this writer, the original meaning of wild gardening is "to enrich places of wild growth with such exotic plants as may thrive and look right in character, using for preference native trees and bushes in large numbers of the *same* kinds, and grouping them, alone or in very simple mixtures of not more than two or three kinds within view at one glance." "If too many kinds are used, it will not be a wild garden at

all, but a planted shrubbery of more ordinary type." And that "the fewer and simpler the kinds of plants chosen, the better will be the result." That "in the wild garden, more than anywhere else, is wanted the simple picture of some one display at a time of some beautiful plant"; and that "no branch of gardening needs more knowledge of plants, or a more careful exercise of restraint and caution in the matter of choice."

I have quoted this writer almost verbatim, partly because æsthetically I agree with all this, and partly for another reason. It is indeed but truth to say that it is only in wild gardens of very large area that the fullest extreme of justice can be done to large subjects, and that plant pictures on the largest scale—those which need a monstrous canvas—can be produced at all.

But I have quoted him also for a second reason, viz., to remind you that it is only the very few by comparison who can have a wild garden on such a scale, or who can have a wild garden at all, if woods made up of but a few species only should form part of it; that the term "wild garden" quite as appropriately belongs to beautiful mixed natural plantings on a *small* scale; and that, while with some few the sole purpose of wild gardening is to create a large picture, or many such, of tree and plant beauty (a purpose than which there is doubtless none better), there are, on the other hand, others for whom that purpose is on one ground or another impossible of fulfilment.

The chief advantages of such a wild garden as I figure to myself and have more particularly in my mind in this paper are the following:—

(1) Economy in first cost, by comparison with the amount of the effect got, with the pleasure given, and with the extent of space furnished. But it must be allowed that the work cannot be done *well* without a *solid first* cost, for such a garden should not be on a *very* small scale.

(2) Still more emphatically, economy (always comparative, of course) in *annual* labour and *upkeep*. Well done originally, it may need little but weeding and thinning.

(3) A natural association of hardy plants with one another—a setting of each in congruous surroundings.

(4) The natural protection from glare and heat secured for the many plants which need it by planting them among other sheltering and surfacing plants.

(5) The high merits of *permanence* as well as *variety*, combined with a long *succession*, through most of the year, of plant beauty and interest.

(6) Last in order, but rather first in importance, is this: that wild gardens lend themselves to the creation of living plant pictures, changing of themselves with the successive seasons. Such gardening may surely come to be recognised later as a branch of fine art, the painting with living material of living and moving pictures.

Site.

Almost first in importance in this matter of a wild garden is the choice of its site. For even more important to it, perhaps, than to any other kind of garden is it that an established framework, or at least back-

ground (an old one for choice), should be found for it. Otherwise the beauty attending maturity, the sense of repose arising from mere age in vegetation, is for many years absent, however many other beauties may be present. The problems of its construction and its furnishing are indeed completely different, according as we have or have not at our disposal, upon or surrounding the proposed site, some existing vegetation, whether of matured Conifers, shrubs or woodlands. Even old hedgerows may for the purpose be made useful, and the round of them on the inner sides of a field of a few acres may give a sufficient background for a wide and varied belt of natural wild garden.

If no such vegetation be already present to serve for background or framework we have the three alternatives of either planting such, whether Conifers or woodlands, in specimens already of some size—or of planting the same in *small* size and waiting years for the result; or of making our wild garden *wholly* of lowlier subjects without background or enclosing girdle. But in this last case the loss is generally great, and should, if may be, be avoided.

A thin wood, or a *thinned* wood, so thin that plentiful light and air are admitted, and that many large spaces are found there, free from the roots of trees—a wide glade in the park or elsewhere—the open side of a wood or covert, or an extensive clearing in it—an old common ready furnished in parts with brake, briar, and bracken, and seamed perhaps with watercourses—even wide disused lanes or manor ways—almost any piece of wild ground, indeed, containing already something of natural beauty, is suitable for our purpose. Of course in any case it must be guarded against rabbits and marauders, human and other.

When no other spot is available an ordinary field, preferably of a few acres, may be made available; the whole field not being necessarily thus used, only a wild and irregular belt round the inside of its hedgerows. In time, by judicious planting and felling, the hedges may be incorporated in the garden to all appearances, while remaining an impenetrable fence.

If the centre of such a field be retained for pastoral or other purposes and fenced off, it is well that the zone of planting should be wide enough, say 100 feet in its narrowest part, to enable a fairly broad track or path to be carried through it or along it. The path is then remote enough from either boundary to induce some sense of privacy.

One sees hundreds of sites for a wild garden such as I have described alongside most of the railways of the country, and conspicuously so in the Home Counties.

It will not often, I think, be desirable to reshape or reform the ground selected for a wild garden. For unless very skilfully done a sense of the artificial is more likely to result than any very solid betterment. But if the contrary view obtain, we cannot, I think, do better than imitate the style of Mr. Milner in laying out ground, and which may not unfitly be described as a rolling "ground-swell."

In what I have just said I have been thinking of wild gardens of some size and importance, and it must, I think, be admitted that some degree of extent is necessary to get completely satisfactory results.

As to paths in the wild garden; in hard soils, or in places lying high, they may often be dispensed with, particularly if the garden be little

visited in winter; but when paths are necessary the usual trim garden path is evidently little suitable. If, as occasionally, a part of a garden be converted into wild garden, and already has paths through it, these will doubtless often be left. But even so, any fancy edgings as of tile or brick should be abolished or masked by over-growth. The paths themselves, too, should by every means be "naturalised," as by reducing them to mere hard and natural-looking tracks, or by allowing them to become moss-grown, or other vegetation to invade them, and by destroying all angular outlines. Since moss rarely survives into the drought of summer, it is an excellent plan to plant mossy Saxifrages in quantity among stones sunk into the sides of the edgings of the paths. These also add their tribute of colour in the flowering season.

Where there are no existing paths, any which are wanted should generally be made on the lines of ordinary woodland or field paths, rather than of garden paths proper. Turf walks may sometimes be suitable and be liked, and gravel tracks, moss or plant-grown, are in good character. I have heard lately that common Ling Heather (*Calluna vulgaris*), mown and rolled annually, makes a good path. Personally I have not seen it so used.

I do not recall, though I may be wrong, that the matter of garden seats has yet been wholly satisfactorily dealt with as respects the wild garden. I have seen and had them admirably modelled in the shape of giant and coloured fungi; but, frankly, they are uncomfortable on the one hand, and the suggestion is disagreeable on the other. Stone seats, too, are generally excellent in appearance and permanence; in every particular, indeed, except as safe and desirable receptacles for the human form.

In order to annex them to this paper I have carefully prepared lists of Conifers, shrubs, creepers, carpeters and plants of all sorts, which are most suitable for the varied purposes and positions of the wild garden. I shall not therefore trouble you with them now. But I think ought to indicate roughly the classes of plants most suitable, as also what I regard as the principles governing the selection. It is also obvious to observe that the selection for any particular soil or locality must be largely governed by special conditions, and by the means at command, as well as by the labour available for keeping the garden in order in the future, or rather perhaps I should say in admired *dis*order.

In my view all strictly "florists' flowers" are unsuitable for inclusion, and natural species or natural hybrids are pre-eminently suitable.

As regards the large class between these two, viz. garden plants which have been improved by art, it is a fair question whether or no to use them. If doubles are generally objectionable because on their face unnatural forms, some, like the clambering Roses, are at once so beautiful and so otherwise valuable for our purpose that they may well be allowed in; and I should think it pedantry to object to include, say, *Clematis Jackmanni*, and still more the Penzance Sweetbriars. A fair rule to go by I should personally think to be, "Will the flower strike one as *unnatural-looking* in such surroundings?"

Annuals and biennials I would generally only include if self-sowing, and, of course, quite hardy; and, as with bulbs, I would generally only

FIG. 6.—A VIEW IN MR. WICKHAM FLOWER'S GARDEN AT TANGLEY MANOR, NEAR GUILDFORD.

Reproduced from] [*"Country Life Illustrated."*

use them when the bulk of the planting has been done. This, first, because neither class can be relied on for prolonged beauty throughout the year; secondly, because the special value of both is generally for filling in and for contrast between and with large and more permanent subjects; thirdly, because they are thus (what by themselves they are *not*) invaluable as a means of easily prolonging the succession of bloom colour at a given spot; and often, fourthly, because, as regards many, they can be carried through and among other plantings.

Myosotis of sorts and Foxgloves, where these will grow, are thus invaluable, almost indispensable, and the kinds of useful bulbs, from Snowdrops, Crocuses, and Daffodils, to Colchicums, autumn Crocus, and Sternbergias, are many more in number than are the annuals and biennials.

It is ordinarily preferable to seek to make the garden beautiful in all seasons, except in those frequent cases where the owners being in residence during but part of the year, it would then be little visited and cared for.

In such exceptional cases provision will probably not need to be made for that season. For instance, Conifers or other evergreens, in a garden not visited in winter, may not be wished, or at least they may fall into a secondary place, and the first place may naturally be taken by foliage plants of quite another character, or by shrubs having only summer beauty. In a sense, more is, naturally and properly, expected, so to speak, of a garden wanted for a limited season only, than in one which caters for the whole year through.

It is far easier then to crowd it, if need be, with colour and with varied beauty, and with such only, than when the demands of several seasons have to be met in the same space. This *still more* as regards the *absence* of what may *offend* the eye, than as regards the *presence* of what will *please* it.

Yet it is, I think, otherwise and generally, a good method in planning the wild garden to go over it systematically with the purpose of securing that every part of it is made interesting or beautiful, or both, so far as possible, at *every* season. This is easier than might at first sight appear.

Suppose that a part of it has been already specially planned and planted for spring or summer effect only; it is generally easy to find room for and to add autumn blooming bulbs, and summer flowering or autumn tinted creepers, even striking winter evergreens, or effects of coloured barks or tracery.

Or suppose that we have set ourselves to plant a conjunction of shrubs and climbers for splendid *autumn* effect; it is easy both to give preference in the selection to subjects which fulfil the double purpose of beauty of flower in the early part of the year and of leaf colour in autumn, and also to add beneath the deciduous subjects an under-growth of spring bulbs and of spring flowering and winter green carpeters. We should in ordinary cases think of each of the four seasons and cater for it, in every 200 square yards of surface that we plant.

Presuming that Conifers and large evergreens are to be included—as I think they should be—I would repeat that I think it is generally wise (if quiet and reposeful effect be the object), first, not to use too many sorts;

secondly, to study those congruous to each other and to their surroundings; and thirdly, on the whole to give preference to our native and naturalised kinds, like Scotch Fir, Juniper, Yew, Holly and Box. It would take me too long to enter in detail on the subject of their arrangement in planting. Happily can we not sum up that matter thus—"Plant as Nature does when at her best," *i.e.* at her most beautiful.

There are few Conifers which may not, I think (given space enough), be well made the chief setting of the wild garden. Those I like least for the purpose are such as have a character little congruous with our native sorts, or at least with North European species. The Wellingtonia, *Picea nobilis, Thuya gigantea*, Lawson's and most Cypresses, even the Nordmann Pine, are instances which occur to me at once as having, according to my notions (beautiful as most of those Conifers are), too foreign an air to be generally wisely included. On the other hand (I scarcely know why) *Pinus insignis, Cupressus macrocarpa, Picea Pinsapo, Pinus Cembra* and *P. montana*, and practically all the Mountain Spruce or the procumbent Juniper class, impress me as thoroughly suitable in the proper situation.

This is really matter of taste. And even those who more or less agree with me in the foregoing doubts may also agree that the class of Conifers which I have been depreciating, for inclusion in the wild garden proper, are admirable for an intermediate purpose, that, namely, of connecting the wild garden with the more formally kept grounds, whether in the form of avenues, Conifer plantings, or as part of a Pinetum.

Speaking broadly, deciduous forest trees should for several reasons rarely be included in the plantings, even as background, although if there already, they may be, "upon terms," left; but Birch of all sorts and small Beech are good exceptions.

I can fancy a *botanical* plant-lover finding a supreme interest and delight in furnishing his wild garden with numbers of native and exotic forms of the smaller and less telling species, even "naturalising" all he may. But this is, and will probably remain, the exception. For, generally, the wild garden will, for long at least, continue to be thought of as the most suitable home for telling plants of large habit, excluded from borders for their size and rankness, yet too beautiful to be absent from the English garden.

Thus the giant Fennels (Ferulas), and the big reeds (Arundo), and Hemlocks (Heracleums), and Aralias and Dimorphanthus, and the Eastern Poppies, and big Polygonums, and ornamental cut-leaved Rheums (Rhubarbs) will take a front rank in the list of herbaceous forms suited especially for the largest spaces, for a single large plant of most of these will each furnish several square yards. I have, too, specially referred to this class for the purpose of a caution. Beautiful and valuable as they are in their earlier growing season, they are many of them ugly and weedy later, and their planting ground should therefore generally be carefully chosen; say a spot to themselves unvisited after early autumn. Or, as an alternative, it involves but trifling labour regularly to cut down the foliage as it becomes sere and ugly, and to scheme that early spring and late autumn bulbs, planted between the grosser subjects, shall utilise the uncovered space and prolong the interest and colouring of the spot.

I may, however, here observe that while (taking such precautions) a

part of the wild garden is pre-eminently the place for those large types of herbaceous vegetation, it is none the less generally wise that in it, as in all other kinds of gardens, the *prominent* positions should be furnished only with those plants and shrubs of all kinds which have no such period of ugliness in their year's growth.

Sightliness throughout the year is, for such positions at least, more important than is conspicuous beauty during one small part of it. Trees, shrubs and plants which have only the latter are well worth growing; but a part of our best work, it seems to me, should be so to place them, without need for shift, that at such times they may display and attract attention to their beauty, while at other times they are out of view or are at least in the background.

One of the most valuable "groups" of plants for our purpose calling for special mention is that of the Rosaceæ, single Roses and Rubus more particularly.

A beautiful wild garden might be made from them only, with or without help from a few kinds of Conifers, from brake Fern, from Rhododendrons (well nigh indispensable), and the like. It would be equally a wild garden whether confined to natural species, or at least to single forms, or not. It would in my judgment be matter of taste only whether it should be thus limited, or whether the 100 splendid garden forms of bush, climbing and rambling Roses should be let in and placed where they may ramble at pleasure. They should in any case be only naturally supported —not staked—and planted in good and deep soil; but the fact that the soil has been made, if such be the case, should not be apparent.

Than the wrinkled Rose of Japan (*Rosa rugosa*) in its many fine forms it would be difficult to name a finer or more useful wild-garden plant, beautiful in leaf, flower, and fruit seven months out of the twelve, and succeeding in every soil.

The allied group of Rubus again (mostly from the American Continent) can nowhere be seen in better character than in the wild garden. The ornamental cut-leaved blackberries make fine fence plants to any enclosure. *Rubus spectabilis* is a beautiful April flowering shrub, as is *R. canadensis rosea* a September one: both contrast well with Berberis. *Rubus deliciosus* from the Rocky Mountains, and *R. nootkaensis* are exquisite if little seen species, and other good sorts will be found in my appended lists.

Plant Ferns and mossy Saxifrage in the shade and shelter of big bushes of these Rubus, as of their brothers the Roses; let brake Fern (not allowed, however, to overpower them) spike up through and around them, and let species Clematis and Vines and other climbers run over and through them.

A word generally as regards such creepers. Bear in mind that the list of them must include tremendously strong growers like *Clematis montana* and big Ampelopsis, and Aristolochias, and Honeysuckles, as well as comparatively weak growers like *Clematis* (*Atragene*) *alpina*, *C. graveolens* and *C. flammula*. If the garden will later be tended by a gardener of the requisite knowledge, the whole of these can be planted without much regard to their strength, for he will cut in and repress them pretty much as need arises. But if this is not so, we must have

much regard in planting to their relative strength. We must reserve the weak growers, such as the Atragene or *Clematis graveolens*, for the best places—for, say, low Hollies, or for select supports like Simond's or other Cotoneaster, or for *Ligustrum Ibota*, or for Rubus—while sending *Clematis montana*, or Ampelopsis and the larger growing Honeysuckles to rampage over hedge or big Yew.

The common white and pink Convolvulus or Calystegia, with *Coronilla varia* as a lower growing creeper, are both as eminently fitted for being thus allowed out "on the rampage" in the wild garden as they are unfitted for the garden proper.

Although the lists which I have added to this paper will best give suggestion to any who need it in regard to the wild garden plants which I commend, the following are so much in the front rank that, in addition to the classes before named, they should, I think, be singled out. I here confine myself to the larger habited :—

Crambe cordifolia, which, as you know, is a giant horse-radish reaching 10 or 12 feet in height, is very striking indeed about August.

The fig-leaved Hollyhock, a distinct species, single, of course, and of a beautiful clear light-yellow flower, very distinct from the florists' flower.

Bocconia cordata ; well known.

The White Willow-herb, in association with tall Delphiniums and Thalictrums.

Large Spireas, such as *S. Aruncus* and *S. ariæfolia* especially, with numberless other species, are conspicuously useful.

Autumn Asters, generally *species* only, such as *A. Amellus* and *A. Bessarabicus*, are here well placed. The hybrid Michaelmas Daisies tend too much to run back into poor form. *Polygonum sacchaliense*, with arching foliage 12 feet high ; *Achillea Eupatorium*, best and tallest of the Yarrows ; Yuccas—but only in suitable well chosen spots ; Acanthus ; Verbascums and large Centaureas ; *Eupatorium purpureum* ; *Telekia cordifolia* ; and perhaps Bamboos should be named : these latter love the sheltered spots which can often be well given to them in the wild garden, but it is a fair question whether they are not more in character, almost by themselves, in a Bamboo Garden hard by.

These are a few out of the best large-habited subjects.

Autumn Tint Planting.

The wild garden of almost all sizes is, as I have said, notably the place for arranging plant-pictures, either for copies of such from Nature or for more original sketches. Here, for instance, is a suggestion for one of some size. For the very small garden it might be unsuitable.

It is a study in autumn tints. I will presume that we have at most but the hedgerow in the background. But where I am just now about planting such on my own account, I am happy in the possession of a background of dark Scotch Fir of some age, than which no backing could perhaps be better.

The quantity of each sort of Conifer, or plant of any kind, must vary of course with the space at command. If you plant but one or two of each sort, the effect will be at most but pretty, and certainly comparatively "niggling."

Here is my selection for such an autumn plant-picture. Those who have not my Scotch Fir backing ready made may well add it, or some substitute for it, some distance in the rear.

In or towards the rear, a piece of *Pinus insignis*, of a beautiful bright light green. In every case the planting is, of course, naturally irregular and at uneven distances. Another piece of *Pinus pungens glauca*, or any other grey-blue or glaucous Pine. Two or three Austrian Pines towards the rear and centre will be less useful to me for their sombre foliage than they would be to others.

These are the large Conifers in the back half of my picture. Others as good may be added or substituted, such as *Pinus Cembra* (the Swiss Stone Pine), *Pinus macrocarpa* in mild localities, and many others.

Then (though many of them will need to be felled some day as they become large) there are a few stray bunches of Larch and Birch, with Spruce, a few Liquidambar, a single Maple, one *Prunus Pissardi*, and some cherry trees of sorts (remember it is tints I am now "collecting"). There is the *principal* material of—speaking roughly—the back half or thereabouts of my picture.

A big, low irregular thicket between the Scotch Fir backing and the rest is well worth making out of Brambles, brake Fern, and the like (in order to vary the form of the planting), and covering with Virginia Creepers of differing colours in autumn, with Honeysuckles and the like.

Towards the centre and foreground it is difficult to find room for the many fine things which lend themselves to massing for splendid autumn colouring. The useful, if hackneyed, *Veronica Traversi*, in biggish bushes, I use for its light bright green; *Pinus montana*, in any of its varieties, for black green contrast. Sea Buckthorn, *Arundo Donax*, and blue Lyme Grass are planted and grouped on the outskirts, in part to relieve stiffness of the Conifers, in part to contribute grey and glaucous tones.

And then for the near foreground we have, all splendid in their autumn tints, *Rhus Cotinus atropurpureus* and *Rhus glaber laciniatus*; *Berberis purpurea*, plum-coloured; *B. Thunbergi*, orange and flame. Perhaps, taken all round, this last is the finest autumn-tinted shrub we have. And the two species together form perhaps the finest conceivable contrast and conjunction for the season. *B. Darwini* and *B. stenophylla*, for their vivid green and spring blossom, may, if there be room, be well added.

Many Cotoneasters are suitable and may be included in my picture. But at any rate the glorious blood-red foliage of *C. horizontalis* must not be absent, side by side with the dark as well as light and grey greens of procumbent or spreading Junipers.

As carpet and undergrowth I have Vacciniums, and the low and creeping shrubby Veronicas of New Zealand (bright green, or grey, or glaucous), and grey Antennarias, and "gullies" of *Herniaria glabra* and Saxifrage.

Probably the number of species which I have included may be even too many to yield the best effects unless the area available be very large; and yet it is not the half of the number, even of "first rates," for our purpose.

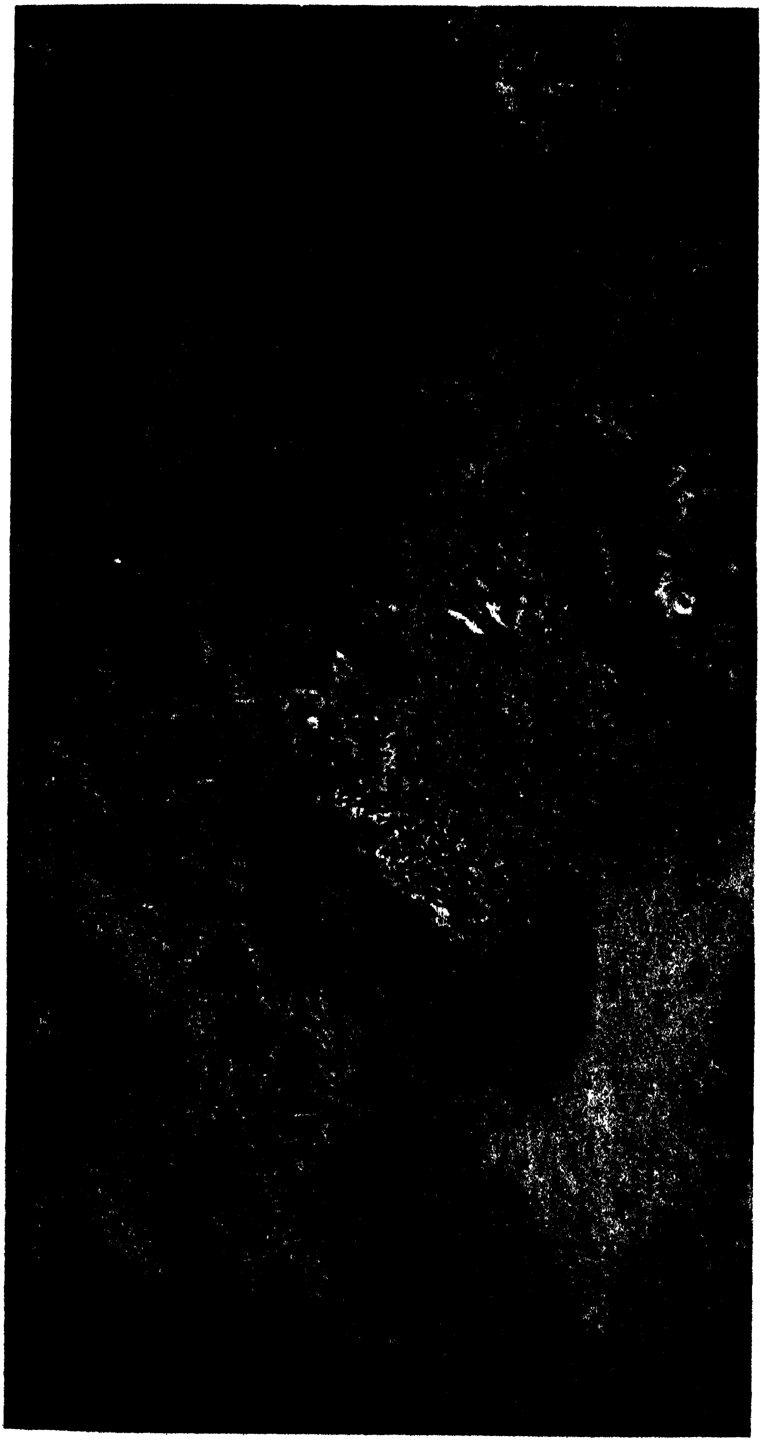

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FIG 7.—A CORNER IN DEAN HOLE'S WILD GARDEN AT CAUNTON MANOR, NEWARK.

STREAM GARDEN.

The bog garden, stream garden, lake or pond garden are species of wild gardens, and any one or more of these may, where circumstances favour it, most advantageously form part of one.

If the smallest streamlet, by diversion or otherwise, be available, though only intermittently, it should be made prominent and available in our wild garden, as by conducting it in Swiss or other simple fashion, through a hollowed trunk, to fall into a pool near the pathway.

I think of no aquatics, or bog plants, or Ferns comprised in our garden flora which are unsuitable for the purpose in hand, for florists' flowers find practically little or no place in the former. I need therefore say nothing about the furnishing.

But there is perhaps place—apropos of such water adjuncts to the wild garden—for an observation which I would also make in regard to the wild garden proper: that I should think it a mistake to exclude from either, in reasonable quantities, the wild plants, whether of land or water, *of the neighbourhood.*

One often hears it said that the garden, however natural, may well exclude such plants as are naturally found just outside it, because they are not wanted. But in wild gardens and natural stream gardens I think such are at least in no way *amiss*, and are indeed even wanted for the purpose of insensibly blending nature *within* with nature *outside* the garden.

Nowhere can more beautiful plant-pictures be made and planted than by the waterside. I think perhaps the most striking effect I ever saw in my life was the mass of self-sown *Primula rosea*, by the waterside at Joldwynds (the late Sir Wm. Bowman's); and it is hard to conceive of aught at once so easy to produce, or more beautiful in the way of large summer effect, than a bog or space by the waterside filled with feathery masses of the better Spireas, associated perhaps with waterside Iris, yellow and purple.

Needless to say, both as regards these waterside plantings as well as all other plantings in the wild garden (though one sees no rule so often offended against), nothing like a *border*, in the gardening sense, should be seen. Now and again thorough preparation of the soil may be, in places, as necessary in the wild garden as elsewhere. But if such prepared spaces look like flower borders of rude outline for a time, the impression should be promptly and permanently destroyed by carrying the furnishing quite to the edge, and, if need be, wholly surfacing the soil between with perennial undergrowth.

I am painfully conscious as I write that a paper like this must, from the nature of its subject, be conspicuously inadequate for its purpose, and can only at the best be suggestive. How could it be otherwise (I am comforted by remembering) when under the term "a wild garden" are included, and justly included, planted places as different from each other as eight acres of woodland loveliness on the one hand, and half a rood of pretty and studied natural wild planting, within a garden, upon the other?

LISTS OF PLANTS SUITED FOR THE WILD GARDEN.

Note.—I have wholly omitted from the lists the great number of choice things needing much care, attention, or culture, however beautiful; and have included but a selection of the rest.

I.—Some Conifers and Large-habited Evergreen Trees and Shrubs specially Suitable for Inclusion.

(a) *Conifers.*

None are wholly and always unsuitable, but the following seem to me the more generally useful :

Austrian Pine
Junipers, of many sorts ; indeed, all the species, excepting the more formal-habited (which are more suited for the formal garden)
Larch
Scotch Fir
Spruce, of many sorts
Cupressus macrocarpa
Picea Pinsapo
„ *pungens glauca*
Pinus Cembra
„ *insignis*
„ *macrocarpa* (in mild localities)
„ *montana*

(b) *Other Evergreen Trees and Shrubs.*

Bamboos, selected sorts, the larger-habited only
Box, in all its species and varieties
Brooms of sorts, including especially *Genista Andreana*, *G. præcox*, *G. alba*, and the Spanish Broom (*Spartium junceum*)
English Yew
Evergreen Oaks
Gorse of sorts, especially the double-flowered form, and *Ulex nana autumnalis* (dwarf autumn flowered), also *U. hispanica*
Hollies, in all their species and varieties
Rhododendrons, all the hardy species if soil not unsuitable
Yews, all species and varieties
Cotoneasters, of many sorts, but especially *C. horizontalis*, *C. Wheeleri*, and *C. Simonsi*
Berberis, in great variety, especially *B. vulgaris*, *B. purpurea*, *B. Thunbergi*, *B. Darwinii*, and *B. stenophylla*
New Zealand shrubby Veronicas (the larger habited), especially *V. Traversii*, *V. buxifolia*, *V. Colensoi*, *V. C. glauca*, and others
Choisya ternata
Diplopappus chysophyllus
Garrya elliptica, and
G. Thuretti

II.—Deciduous Trees and Large Shrubs commonly Suitable.

These should generally be confined to the smaller, or slow-growing, species, as distinct from those forest trees which are of large habit.

Cut-leaved Alder
Apple, Chinese flowering (*Malus floribunda*), and its many varieties; Siberian Crab, and all other fine flowering Apples, whether as standard trees or as dwarf bushes
Beech, of sorts ; to be generally removed as they age
Cherries, of sorts ; both for spring bloom and autumn tint of foliage ; include Japanese flowering sorts
Maple
Sea Buckthorn
Rhus Cotinus, of sorts, and other species
Euonymus europæus monstrosus
Halesia tetraptera
Hedysarum multijugum
Mespilus canadensis
Prunus Pissardi, and flowering Peaches and Plums generally ; many varieties, single and double
Pyrus (*Cydonia*) *japonica*, in great variety
Philadelphus, of sorts
Syringas, of sorts
Weigelas, of sorts
Rhus glaber laciniatus

III.—Climbers.

(a) *Strongest growing.*

Honeysuckles
Virginian Creepers, many sorts
Periploca græca
Akebia quinata
Aristolochia Sipho
Calystegias
Clematis, especially *C. montana* and *C. vitalba*
Vitis Coignetiæ, and others

(b) *Climbers of medium or less strength.*

Apios tuberosa
Clematis, of many sorts, generally species, *e.g. C. graveolens, C. flammula, C. (Atragene) alpina, and C. cirrhosa*
Jasminum nudiflorum
Lathyrus (perennial pea)
Polygonum baldschuanicum
Tropæolums (*T. speciosum*, where conditions favourable)
Vitis heterophylla variegata

(c) *Trailers.*

Chimonanthus
Coronilla varia
Forsythias
Galegas
Hederas
Jasminum
Kerrias
Lathyrus
Loniceras
Muhlenbeckia complexa
Piptanthus nepalensis
Pyrus (Cydonias), many fine kinds
Tropæolums, many species
Wistarias
Roses (species and singles only), of many sorts, especially : —
Rosa alpina
„ *lucida*
„ *rubrifolia*
„ *Brunonii*
„ *cinnamomea*
„ *polyantha grandiflora*
„ *multiflora*
„ *rugosa*, in variety: and many others
Rubus, of many sorts, especially *R. biflorus, R. laciniatus*, and *R. Phœnicolasius*

IV.—Plants (generally Herbaceous) suited for the Wild Garden.

I have thought it well (following the opinion of most) not to exclude plants which have been improved by art; but some will prefer to confine themselves to purely natural species.

(a) *Large-habited Plants, fine either in flower or in leaf, or in both.*

Acanthus, of sorts
Aralia (*spinosa* and other hardy species)
Arundo Donax
Cephalarias
Crambe cordifolia
Dimorphanthus mandshuricus
Elymus glaucus (Blue Lyme grass)
Eupatorium purpureum
Eremurus, of sorts
Ferulas, several species
Genistas, in variety
Helianthus orgyalis
Heracleums, several species
Iris, the larger-habited, especially *I. (gigantea) ochroleuca*
Knautias
Macleaya (Bocconia) cordata
Molopospermum cicutarium
Onopordon tauricum
Pæonies of sorts, specially singles
Papavers (Poppies) many sorts.
Polygonums (*P. cuspidatum, P. sachaliense* and *P. compactum*, the last generally preferable)
Phytolacca decandra
Rheums (ornamental Rhubarb)
Rubus, of sorts
Scabiosa ochroleuca (the giant yellow species)
Silphium perfoliatum
Spireas, the largest sorts, *e.g. S. ariæfolia, S. Aruncus, S. gigantea, S. Lindleyana* and many others
Symphytums
Telekia cordifolia
Ulex europ. flore pleno
Verbascums, larger sorts
Veratrum album and its variety *V. a. nigrum*
Yuccas, in select positions only.

General Note.—Not infrequently an item may be found repeated in a second or even in a third list. In such cases it will often be found not unsuitable for the purposes of each.

(b) *Less vigorous, but still strong, Herbaceous Plants for like purposes.*

Asphodels
Pæonies, many kinds, especially singles
Poppies, *e.g. P. orientalis* and *P. bracteata* and their hybrids, in variety, also *P. pilosum* and *P. atlanticum*
White Willow-herb
Achilleas, especially *A. Eupatorium* (large var.)
Aconitums
Althæa ficifolia, a distinct species of Hollyhock, single-flowered (fig-leaved)
Anchusa, of sorts
Anemone japonica and its varieties
Asters, perennial kinds only, especially *A. Amellus* and *A. Bessarabicus*
Astilbes, especially *A. rivularis*
Bambusas, the strong growing species only
Campanulas, the larger sorts only
Centranthus ruber
Cistus, in variety, especially the hardy *C. ladaniferus* and its varieties (other species only in dry soils, and mild hot spots)
Delphiniums
Doronicums
Echinops
Eryngiums
Eupatoriums
Funkias
Galegas
Geraniums, herbaceous
Gypsophila
Helianthus
Hemerocallis
Hydrangeas
Iris, especially the German Iris in great variety, and the moisture-loving species for bog garden
Lilium tigrinum, and a few other species; the majority of sorts are generally unsuitable as they require some culture
Lupinus polyphyllus
Lythrum roseum superbum
Mulgedium Plumieri
Œnothera Lamarckiana and other large kinds
Polygonums, especially *P. compactum*
Pyrethrum uliginosum
Rudbeckias, the taller species
Solidagos
Spireas, medium-sized, many species
Statice latifolia
Symphytum bohemicum
,, *caucasicum*
Thalictrums
Tritomas
Veratrum album
Verbascums, medium-sized, especially *V. Chaixii*
Veronicas, larger herbaceous sorts
Yuccas

(c) *Comparatively dwarf or weaker Plants for like purposes, positions for which must generally be chosen more carefully, that they may not be strangled by strong growing neighbours.*

Heaths, in variety, where soil suitable; especially *Erica carnea* and *Calluna vulgaris* (Ling)
Anemone sylvestris, and others
Anthericums
Aquilegias of many sorts
Arum italicum, and other hardy species
Asarum europæum
Astrantia major
Borago laxiflora
Campanulas, medium sized
Centaurea orientalis
Daphne
,, *Cneorum*
,, *Laureola*
Daphne Mezereum
Dielytra eximia
,, *formosa*
Digitalis grandiflora—perennial yellow flowered
Doronicums, smaller sorts
Epimediums
Funkias
Geraniums (*G. sanguineum*, *G. platypetalum*, and others)
Helleborus (*H. fœtidus*, *H. caucasicus punctatus*, *H. niger*, and others)
Hyacinthus candicans
Hypericums, many suitable, especially *H. Moserianum*

Iris, many sorts, carefully chosen
Lithospermum purpureo-cæruleum and others
Meconopsis cambrica
Monarda didyma
Melittis melissophylla
Orobus vernus, and others
Œnotheras, smaller sorts
Physalis Alkekengi and *P. Franchetti*
Plumbago Larpentæ
Polygonum Brunonis
Pulmonarias
Ranunculus aconitifolius
" *amplexicaulis*
Scabiosas
Spireas, smaller sorts
Statices
Trollius
Trilliums
Tussilago fragrans
Verbascums, smaller sorts, *e.g.* *V. phœniceum*
Veronicas, New Zealand shrubby species

(d) *Carpeters or dwarf Plants, vigorous enough for inclusion under frequent conditions.*

Violets
Alyssums
Anemones, of many sorts
Antennarias
Arabis
Asarum europæum
Aubrietias
Campanulas, smallest sorts
Cerastiums
Cyclamen
Ericas
Ficaria grandiflora
Genista sagittalis
Gentiana acaulis
Helianthemums
Herniaria glabra
Hieracium aurantiacum
Iris, small sorts, such as *I. pumila* in variety, *I. cristata*, &c.
Mimulus, in variety
Myosotis of sorts
Omphalodes verna
Oxalis, of sorts
Phlox frondosa
" *reptans*
Polygonum vaccinifolium
Saponaria ocymoides
Saxifrages of many kinds
Sedums, very many species
Sempervivums, many species
Thymus, in variety
Vacciniums, in variety
Vincas
Vittadenia triloba
Waldsteinia trifoliata

V.—Trees, Shrubs and Plants, generally Rabbit-proof.

Canterbury Bells
Common Privet
Common and Irish Yews
Honesty (Lunaria)
Lilies, common orange and white kinds
Lily of the Valley
Monkshood
Periwinkle (large and small)
Poppies
Primroses, in variety
Roses
Solomon's Seals
Violets
Winter Aconite
Woodruff
Anemone coronaria
" *japonica*
Arabis
Asphodelus albus
Aubrietias
Berberis Darwinii
Cineraria maritima
Deutzia scabra
Erythroniums
Fuchsias
Iris
Lycium barbarum
Mahonia aquifolium
Muscari
Narcissus
Ruscus aculeatus
" *racemosus*
Scillas
Loniceras, in variety
Tritomas
Weigelas

VI.—Some suitable Bulbs or Plants which will grow beneath Deciduous Trees (and often on the fringe of Evergreen ones).

Asarum europæum
Brambles
Ferns (including bracken)
ilies of the Valley
Snowdrops—Chionodoxas and Scillas
Solomon's Seal
Violets, selected sorts and distinct species
nemone apennina
,, *nemorosa*
,, *japonica*, of sorts
,, *ranunculoides*
,, *fulgens*, and others
rocus, spring and autumn flowering
Cyclamen
Epimediums
Epigæa repens
Eranthis hyemalis
Erythroniums
Funkias
Galax aphylla (in peat)
Gentiana asclepiadea
Helleborus
Hepaticas
Hypericums
Iris fœtidissima
Lithospermum purpureo-cæruleum
Muscari, of sorts
Myosotis, of sorts
Narcissus, of sorts
Omphalodes verna
Oxalis
Primula acaulis, in variety
Pyrolas, in variety
Scilla nutans, in variety
,, *campanulata*, in variety
Trillium grandiflorum
Tulips, species, same sorts
Vincas

VII.—Some of the most suitable Annuals and Biennials. These may be generally planted among other Larger and Perennial Subjects.

Foxgloves
Poppies, of sorts
Campanula media
Hedysarum coronarium
Myosotis, of sorts
Œnothera Lamarckiana
Omphalodes linifolia
Platystemon californicum
Silene Armeria
Verbascums (*phlomoides*, and others)

VIII.—Some of the Bulbs, Spring or Autumn Flowering, most suitable.

Lilies (*L. umbellatum*, *L. croceum*, *L. tigrinum*, *L. Martagon*, and a few others)
Tulips (species), in considerable variety
Anemone apennina
,, *blanda*
,, *fulgens*, and others
Camassia esculenta
Colchicums
Crocus of sorts, especially *C. speciosus*, *C. Imperati*, *C. biflorus*, and *C. longifolius*
Cyclamen, in variety
Eranthis hyemalis
Erythronium dens-canis
Fritillarias, of sorts
Hyacinthus amethystinus
,, *azureus*
Iris, in great variety
Leucojums
Merendera Bulbocodium
Muscari, of many sorts and colours
Narcissus, in great variety
Ornithogalum umbellatum, and some other species
Sanguinaria canadensis
Scillas, specially *S. nutans* and *S. campanulata*, in all their colours
Sternbergias, of sorts
Triteleia uniflora
Trilliums

IX.—Some of the best Bog Plants.

Water-dock
Arundos
Astilbes
Calla palustris
Calthas, single and double
Cardamines
Cypripediums (*spectabile*, and others)
Droseras
Epilobiums
Galax aphylla
Gentiana asclepiadea
„ *Andrewsii*
„ *Saponaria*, and others
Gillenia trifoliata
Gunnera scabra
„ *manicata*
Helonias bullata
Iris, moisture loving only, *e.g.*, *I. ochroleuca*, *I. orientalis*, *I. aurea*, *I. pseudacorus* of sorts, *I. Monnieri*, *I. Mon-Spur*, *I. lævigata* (Japanese), &c.
Lythrum roseum superbum
Myrica Gale (Bog Myrtle)
Podophyllum peltatum
„ *Emodi*
Polygonums, of sorts
Primulas (*japonica*, *P. rosea*, *P. denticulata*, of sorts)
Sanguinaria canadensis
Saxifraga peltata
Sarracenias
Spireas, in great variety
Thalictrum flavum
Trillium grandiflorum
Trollius
Hardy Bog Ferns, in fine variety, native and exotic
Forget-me-nots, of sorts

X.—Aquatic Plants.

Acorus, of sorts
Alisma, of sorts
Aponogeton distachyum
Butomus umbellatus
Callas
Hottonia palustris
Hydrocharis (Frogbit)
Menyanthes trifoliata (Bog Bean)
Nymphæas, of sorts (Water Lilies), including the finer hardy hybrids
Orontium aquaticum
Pontederia cordata
Ranunculus aquatilis
„ *Lingua*
Sagittarias, of sorts
Scirpus, of sorts
Sparganium ramosum
Typhas (Bullrush), of sorts
Villarsia nymphæoides

XI.—Selection of Plants most suitable for Wall-gardening, *i.e.* for Retaining-walls and others.

Alyssums, in variety
Achilleas (*tomentosa*, *Clavennæ*, &c.)
Antirrhinums
Arabis, of sorts
Arenaria montana, and others
Armeria Cephalotes
Aubrietias, many kinds
Campanulas (*garganica*, *cæspitosa*, &c., and other dwarfs)
Cerastium (*tomentosum*, *arvense*, *compactum*, and other species)
Cheiranthus alpinus
„ *Cheiri*, and others
Corydalis, of sorts
Dianthus cæsius
„ *deltoides*
„ *petræus*, and others
Drabas, especially *D. aizoides* and *D. bruniæfolia*
Erinus alpinus, of sorts
Erigeron mucronatum (? = *Vittadenia triloba*)
Erodiums (*E. Reichardii*, and others)
Ferns, small hardy Ferns, especially Ceterach and some Aspleniums
Gypsophilas, *e.g.* *G. repens*, *G. muralis* and *G. prostrata*
Helianthemums
Hutchinsia petræa
Iberis, of sorts
Ionopsidium acaule (annual)
Iris pumila, now in fine variety
Linarias, in variety
Lychnis alpina
Saponaria ocymoides splendidissima
Saxifrages, many species
Sedums, very many species
Selaginella helvetica
Sempervivums, in great variety
Tunica Saxifraga

The whole of the above, with many others, are suitable where the

wall is a "retaining" one, *i.e. backed by soil.* Only a part of them are suitable for other cases.

Note.—Desiring to make the above lists more complete and accurate with a view to further publication, I shall be obliged to any Fellows of the Society, or other readers of the foregoing paper and lists, who may have had practical experience in the matter, if they will communicate to me (*a*) any *conspicuous* omissions of plants *notably* suitable for inclusion; and (*b*) any items included which experience may have shown, under certain conditions, to be markedly *un*suitable.

FIG. 8.—NARCISSUS INCOMPARABILIS SIR WATKIN. (*Journal of Horticulture.*)

RECENT DEVELOPMENTS IN THE TREATMENT OF DISEASES AND INSECTS INJURIOUS TO ORCHARD CROPS.

By Professor S. A. Beach, New York State Experiment Station, Geneva, U.S.A.

The last quarter-century has witnessed remarkable changes in the means and methods used for combating injurious insects and plant diseases. Greater achievements appear to have been made in this direction than along any other line of general horticultural practice. During this period investigators have continually been adding to our knowledge of the habits and life histories of insects and parasitic fungi which are of economic interest to the horticulturist. Many new fungicides and insecticides have been tested. The best of these have been adopted by progressive gardeners and fruit-growers in various parts of the world. Their practical value is now generally acknowledged, even by those who do not avail themselves of their benefits.

These achievements have stimulated the progress of certain horticultural industries, because they have established them upon a more secure foundation by making it possible to protect plants and plant products from the ravages of certain destructive enemies hitherto practically beyond control.

The introduction of Arsenical Insecticides.—Is it not strange that former generations bequeathed to us so little knowledge of the use of poisons for killing leaf-eating insects? The introduction of Paris Green for this purpose marked a new era in the use of insecticides and in the development of spraying machinery. It is but little more than thirty years ago that Paris Green was first used for poisoning insects. The people of the northern portion of the United States of America, east of the Mississippi River, were then regarding with grave anxiety the resistless progress of the Colorado Potato Beetle, *Doryphora decemlineata*, from its original home in the Rocky Mountains across a stretch of 1,800 miles of territory to the Atlantic Ocean, threatening destruction to one of the most important of the food plants of this region, the Potato, *Solanum tuberosum.* The discovery that a paint pigment known as Paris Green could be relied upon to poison this insect without injuring the Potato plant was naturally hailed with delight. It was finally demonstrated that this remedy could be applied without poisoning the portion of the plant which is used for human food and without sterilising the soil. So once again an evident calamity proved to be a blessing in disguise. The much-dreaded Potato Beetle drove men to the discovery of means of fighting successfully not only this but many other injurious insects. Arsenical compounds in one form or another are to-day largely depended on in fighting leaf-eating insects as a class.

Fungicides.

The introduction of Bordeaux Mixture.—It is but little more than fifteen years ago that the discovery was made near Bordeaux, France,

that a mixture of copper sulphate and lime properly used on Grape foliage prevents the attacks of Grape mildew. This preparation took the name of Bordeaux Mixture. Since then many other preparations containing other copper salts or various other poisons have from time to time been compared with Bordeaux Mixture, but after much experimenting in this way the Bordeaux Mixture has come out ahead of all competitors as a cheap and effective preventive of certain plant diseases which are caused by attacks of parasitic fungi. It has not been used with much success against bacterial plant diseases. In the treatment of certain superficial mildews, such as the Gooseberry mildew, *Sphærotheca mors-uvæ*, which is quite destructive to English Gooseberries in America, potassium sulphide has given better results. With these exceptions Bordeaux Mixture stands to-day pre-eminently the best fungicide for use against those parasitic fungi in general which attack the host plant through the leaves.

Numerous scientific experiments, together with the lessons from practical experience, have led to modifications from time to time of the formulæ and methods of preparing the material for spraying, and also of the apparatus designed for applying the spray.

Strength of Bordeaux Mixture.—When the Bordeaux Mixture first came into use it was applied in the form of a comparatively thick heavy mixture. Finally it was found that practically as good results were obtained from the use of much thinner, weaker mixtures, which not only had the advantage of being somewhat cheaper, but they were more easily applied. In the Eastern United States it has been demonstrated that formulæ calling for one pound of copper sulphate to make ten or eleven gallons of Bordeaux Mixture secure practically as good results in orchards and vineyards as the old formula, which required one pound of copper sulphate to make about four gallons of the mixture. In spraying Potato plants to prevent mildew and mould, it has been found best to use somewhat stronger mixtures than those used in orchards, and in such treatments, therefore, one pound of copper sulphate is used for making seven or eight gallons of Bordeaux Mixture.

Preparation of Bordeaux Mixture.—Several years ago Swingle called attention to the advantage of diluting the ingredients of Bordeaux Mixture as much as possible before mixing them.* This process insures a mixture in which the solid particles remain in suspension for a remarkably long time, and consequently the spraying apparatus by which it is applied is less apt to become clogged than it is when the mixture is made according to the old method of mixing the concentrated ingredients, and afterwards diluting the mixture to the required strength. How much less rapidly Bordeaux Mixture settles when prepared by the improved method, than it does when made in the old way will be at once seen by comparing figs. 9, 10, and 11, which are reproduced from actual photographs. And this point is of especial importance where the spraying apparatus is run by steam or horse power. It is then desirable to have a mixture of uniform consistency at all times so as to avoid clogging the apparatus as much as possible.

When large quantities are to be used, it has been found convenient for the preparation of the Bordeaux Mixture to keep constantly on hand

* Bul. 9, *Div. Veg. Phys.*, U.S. Dept. Agr., 1896, 18.

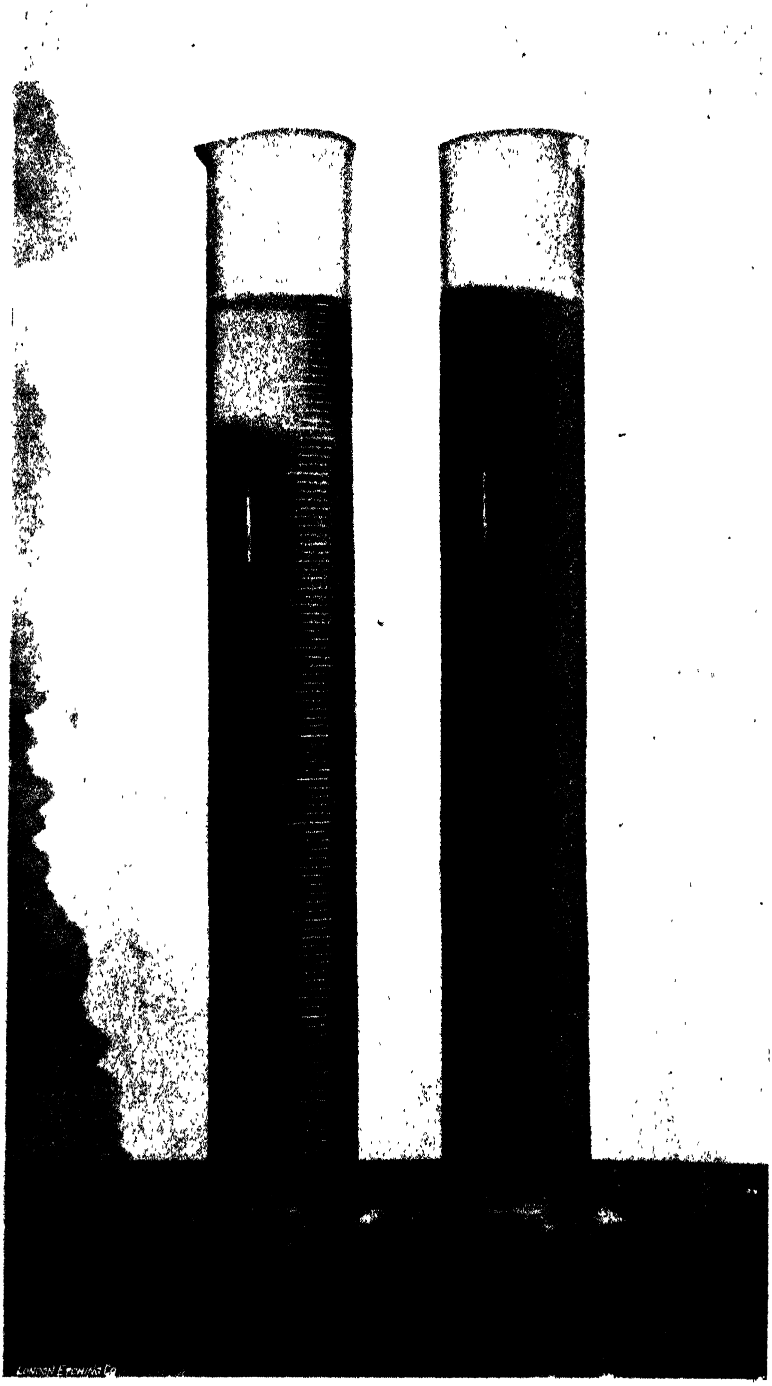


FIG. 9.--THE OLD WAY. THE NEW WAY.
After standing five minutes.

FIG. 10.—THE OLD WAY. THE NEW WAY.
After standing twenty minutes.

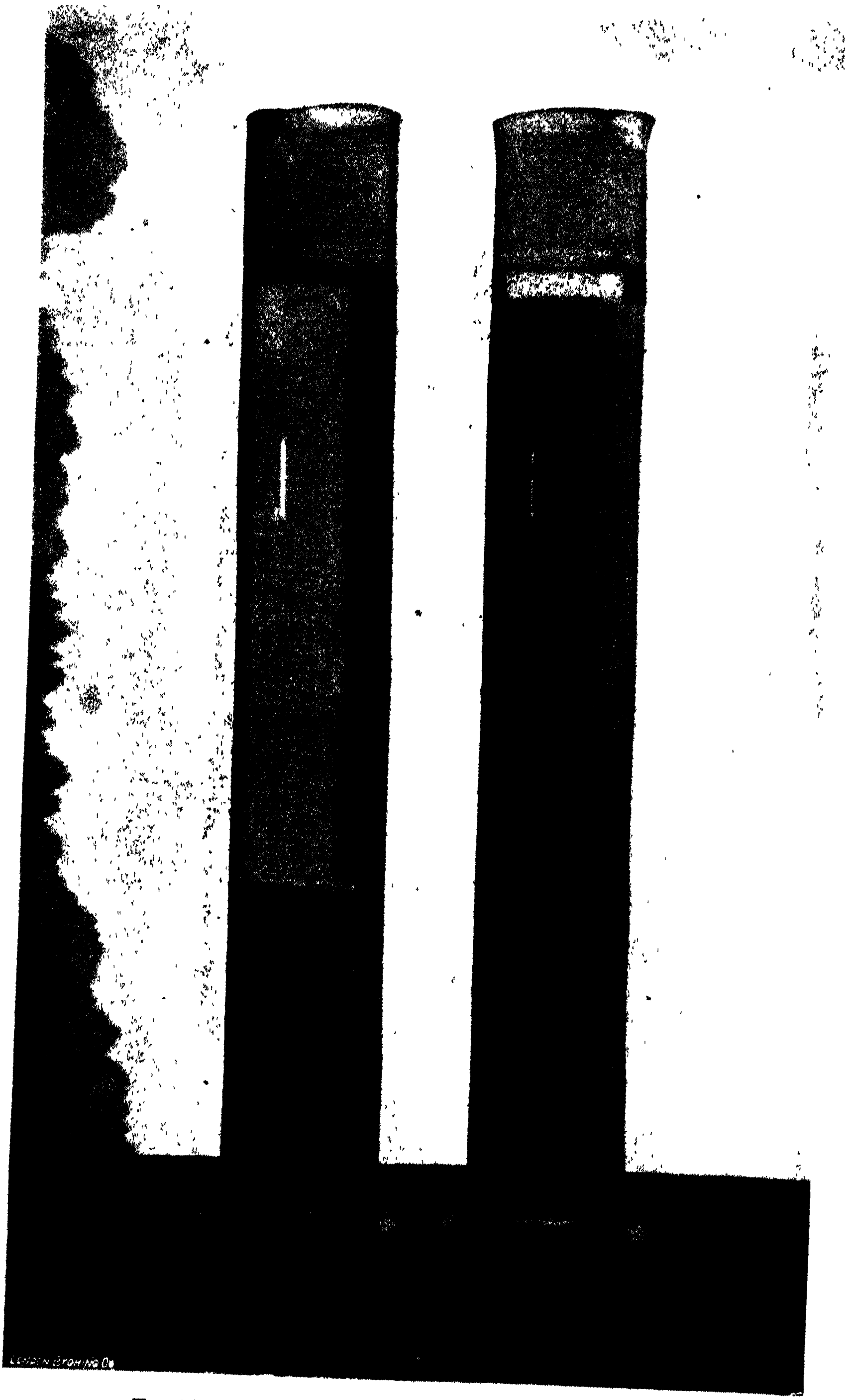


FIG. 11.—THE OLD WAY. THE NEW WAY.
After standing one hour.

a saturated solution of the copper sulphate, and thus avoid the delay of dissolving the copper sulphate each time the mixture is made. At ordinary temperatures the saturated solution contains about three pounds of copper sulphate per gallon,* and for all practical purposes in making Bordeaux Mixture it may be reckoned at that amount. It is then easy to calculate how much of such a solution must be taken to get the number of pounds of copper sulphate which is called for by the formula.

The lime may be kept on hand slaked and ready for use, if after it has been slaked the air is excluded. This may be done by keeping it covered with water; it will then keep indefinitely in good condition. The weighing of the lime to determine the amount required by the formula is obviated by using a simple colour test, which shows instantly whether enough lime has been added to combine with all of the copper sulphate. This, which is known as the potassium ferrocyanide test, has successfully stood the trial of practical use for several years.

INSECTICIDES.

Combining Insecticides and Fungicides.—The cost of treatment with fungicides and insecticides may be much reduced when both can be applied at one operation. For perhaps ten years or more it has been a common practice to combine the arsenical insecticides with Bordeaux Mixture when both are needed.

Substitutes for Paris Green.—Paris Green long held front rank as an arsenical insecticide. It is decidedly more expensive than other arsenical poisons, and some of these are now being substituted for it in many places and in increasing quantities. Prominent among these may be mentioned a green arsenite of copper, which represents about the same amount of arsenious oxide as Paris Green and is used pound for pound in place of that substance as an insecticide. It has the advantage of being much cheaper than Paris Green, and it is also better adapted for use in a spray mixture, because being an amorphous, impalpable powder, instead of crystalline, it stays much longer in suspension in liquid mixtures than does Paris Green.

A still cheaper and equally efficient arsenical insecticide is a home-made preparation of sodium arsenite. It is made by boiling white arsenic in sal. soda (sodium carbonate) till it dissolves. It may then be bottled or otherwise kept from evaporating, and may be used in all formulæ in place of Paris Green. So much of the liquid as represents one pound of white arsenic is taken in place of two pounds of Paris Green. Milk of lime should be added to prevent injury to the foliage unless it is combined with Bordeaux Mixture.

One of the best arsenical insecticides, doubtless, is arsenate of lead. For the addition of this to the list of insecticides we are indebted to another insect foe, namely, the gypsy moth. This insect was introduced into Massachusetts from Europe not many years ago. For fighting this terrible pest the State of Massachusetts has already appropriated an aggregate equivalent to more than £200,000. The experiments of the

* At 59° F. a gallon of saturated copper sulphate solution contains about 49 oz. of copper sulphate.

Massachusetts Gypsy Moth Commission have established arsenate of lead as one of the most desirable of arsenical insecticides.

It is less liable to injure the foliage than Paris Green; its colour is such that it shows plainly where it has been applied. It remains in suspension in water so well that there is no difficulty in applying it at uniform strength.

Insecticides for use against insects having sucking mouth parts.—Kerosene emulsion has for many years been used against insects having sucking mouth parts, such as scale insects, aphis, &c. The fruit grower, however, looks upon the preparation and application of this substance as a very disagreeable task. It is not surprising, therefore, that there has appeared within recent years spraying apparatus designed to mix kerosene and water mechanically when the spray is applied and thus dilute the kerosene to any desired extent and at the same time apply it constantly at a uniform strength. Various kinds of apparatus designed to do this work have been put upon the market. In some cases there are conflicting reports as to the safety and reliability of this method of using kerosene as an insecticide, and the process is regarded by many conservative horticulturists as being still in the experimental stage.

Since the San José Scale has invaded some of the important fruit growing sections of the Eastern United States, horticulturists and entomologists have studied every way that ingenuity could devise for keeping such an insect under control. In California fumigation with hydrocyanic acid gas, one of the most deadly gases known, has come into extensive use against this insect on orchard trees, the trees being covered with tents during the process of fumigation. A wash known as the salt, sulphur, and lime wash is also used on dormant trees. In the Eastern United States the former has not come into use, and the latter of these remedies has not passed beyond the experimental stage in orchard work. The fumigation treatment for orchard trees in this section has not always been attended with satisfactory results; however, some of the most recent experiments are giving very encouraging results. In the climate of the Eastern States the trees appear to be more liable to injury from such treatment than they are in California.

But the advent of the San José Scale into the Eastern United States has had at least one beneficent result. In order to keep it as much as possible under control many States have adopted some system of orchard and nursery inspection for the purpose of preventing the introduction of this insect into uninfested localities and to check its spread in infested localities as much as possible. Some States even require the fumigation of all nursery stock before it is delivered. The lines of treatment which have been put into practice because of the San José Scale have unquestionably tended not only to prevent the dissemination of this insect on nursery stock, but at the same time and in like manner have also prevented the spread of other insect pests of economic importance. Fruit growers in many cases are taking up the position that it is safest to have all stock fumigated before receiving it on their premises. Many nurserymen, therefore, who live in States where fumigation of nursery stock is not compulsory find it to their advantage to fumigate all stock which they deliver. Accordingly they have built fumigatoriums and

fumigate all stock before it is sent out. At the same time, with flourish of trumpets they do not forget to proclaim abroad the protection which they are giving to their customers by this operation.

It may be remarked, by the way, that fumigation with hydrocyanic acid gas has been tried in greenhouses.* It cannot be said that experiments have shown its limitations as to safety with all classes of plants, but it has been used with excellent results on low growing plants, as, for example, violets and lettuce. On chrysanthemums, carnations, and plants of taller habit than violets it may be used when plants are small and low. It cannot be used safely where plants grow near the glass, or where loosely constructed houses permit draughts during the process of fumigation and tend to cause banking of the gas.

SPRAYING APPARATUS.

When the value of Paris Green as an insecticide was first demonstrated the conditions were such as to force the extension of its use for the protection of various crops in field, orchard and garden. Various kinds of apparatus for the application of this and other poisons of similar form soon began to be devised. An exhibition now of these really primitive appliances would remind one of a museum of weapons and armour of ancient and medieval ages, so completely have they been replaced among progressive agriculturists and horticulturists by improved apparatus.

The application of insecticides in liquid form in most cases gradually displaced other methods, but it was not till after the introduction of Bordeaux Mixture that spray pumps came to be a common article of farm and garden machinery. The Bordeaux Mixture was at first used as a thick heavy mixture. Repeated experiments afterwards demonstrated that when diluted so as to pass readily through force pumps and spray nozzles it could thus be applied most rapidly and effectively. Then the spraying apparatus which had already been developed for applying Paris Green and such insecticides was at once pressed into service for the application of the Bordeaux Mixture. As the merits of Bordeaux Mixture became better known the demand for spraying machinery naturally increased. This, in turn, led rival manufacturers to strive to bring out the best appliances which they could put on the market at reasonable prices. Improvements in spraying apparatus have kept pace with the demand for spraying machinery. There was at first, quite naturally, among farmers and fruit growers a greater demand for the less expensive spray pumps of comparatively small capacity. But as the practice of spraying became more thoroughly established among them, the bucket pumps, knapsack sprayers, and the weaker types of barrel pumps quite largely gave place to the stronger types of hand pumps or to pumps driven by horse-power or steam. In barrel pumps an important improvement was made when pumps of the type of the so-called Eclipse and Pomona were introduced. In this type of apparatus the pump is placed near the bottom of the barrel or tank, so that it is not necessary to lift the liquid the length of the barrel before it can be forced through the pump as must be done with pumps which are mounted outside the barrel or tank.

* See also *R.H.S. Journal*, vol. xxv, p. 305

Horse-power sprayers are coming more largely into use among fruit growers now than formerly. One of the best recent devices of this class is fitted with a very large air-chamber and has a hand pump near the driver

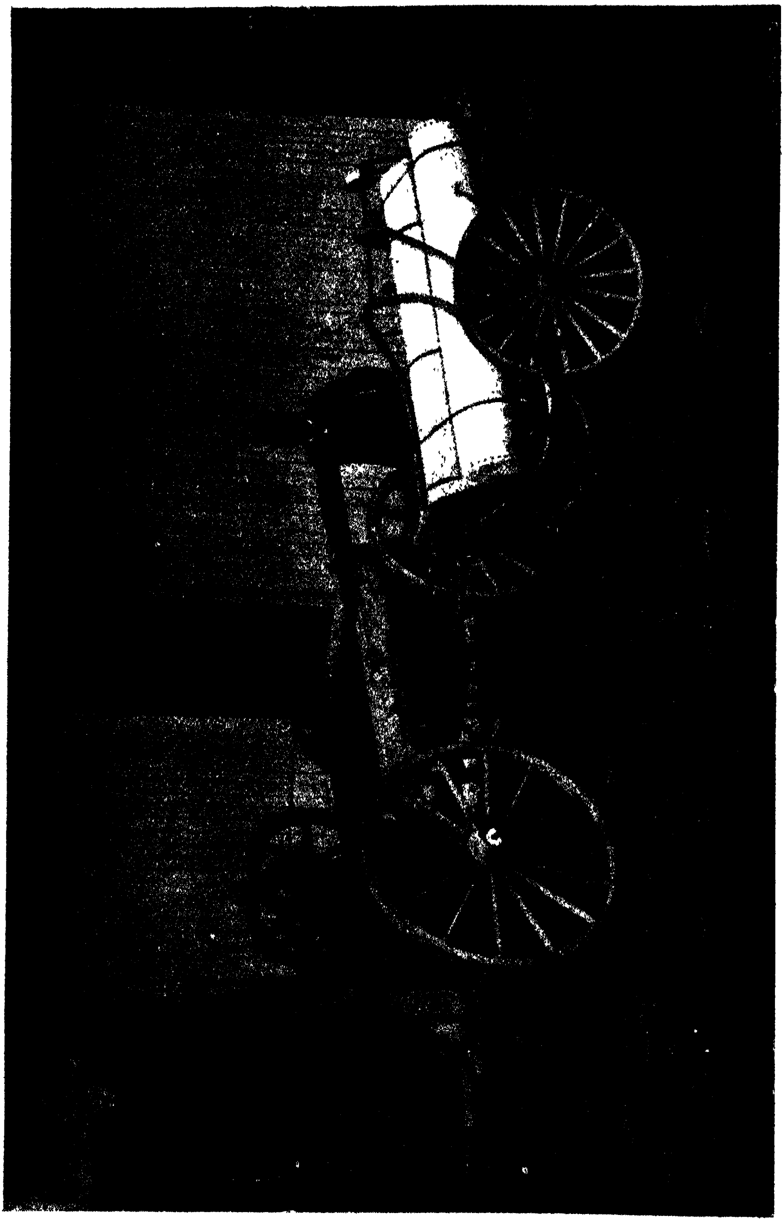


FIG. 12.—COMPRESSED AIR APPARATUS ILLUSTRATING THE OPERATION OF CHARGING THE SPRAYING MACHINE WITH COMPRESSED AIR.

in addition to the horse-power pump. In passing from one tree to another enough pressure is obtained from the horse-power pump to run the spray for several minutes. If a large tree is to be sprayed, however,

the pressure may go down before the spraying is completed. A pressure gauge shows the driver when the pressure is low, and he immediately operates the accessory hand-pump till the tree is sprayed.

Steam spraying outfits are being used in the larger orchards and also by the park departments of cities and towns with satisfactory results. Some of these are fitted simply with steam pump, and depend upon horse-power, taken by means of sprockets on the wagon wheel, for running the agitator. Others have an engine, which runs both the pump and the agitator, mounted on the wagon which carries the pump. Some use kerosene or gasoline for fuel, others burn coal.

One of the recent designs in spraying apparatus which is worthy of notice provides for the use of compressed air for spraying. Upon a two-wheeled cart is mounted one tank for holding the compressed air and another for the Bordeaux Mixture, the two being connected with ¼-inch pipe. A steam gauge shows the amount of pressure. When a spray is desired a valve is opened so that the compressed air forces the Bordeaux Mixture out in a fine spray. The amount of pressure admitted to the liquid is regulated by the extent to which the valve is opened. One horse takes the spray cart even over rough hillside vineyards without upsetting, and the spray continues uniform regardless of the position of the liquid in the tank. No agitator is used, and if the spraying is uninterrupted and the mixture properly prepared none seems to be needed. The outfit consists of two carts like the one described and a gasoline engine and air pump for supplying the compressed air. While one cart is being used the tanks on the other are being filled, one with compressed air and one with the Bordeaux Mixture, so that on the return of the first cart the second is ready to be used. The engine and air pump are mounted on a one-horse wagon so that they may readily be moved to any place most convenient to the field of operations where water for the spray mixtures may be obtained. This outfit gives the owner excellent satisfaction. It does the work well and easily. So far as I know, no apparatus of this kind has yet been put on the market by any manufacturing concern. The owner has purchased the various parts and constructed the apparatus himself. This device is doubtless the forerunner of a new type of spraying apparatus for orchard use in which compressed air tanks will supplant spray pumps. The idea of using compressed air for spraying is not new. Some years ago apparatus for vineyard use were put upon the market in France, but the machine which has been described above is the first compressed air sprayer which I have seen constructed in America for orchard use. It will commend itself to the commercial orchardist because it does away with the labour of working a spray pump.

Orchard Diseases not yet Controlled by Spraying.

One class of orchard troubles should perhaps be mentioned in closing, namely, those diseases for which no remedy is as yet known.

The Peach Yellows disease continues to claim its victims, while the cause of it is still a mystery. The only treatment recommended is the immediate destruction by fire of the affected trees. Another Peach disease, which in some orchards is even more destructive than the Yellows, is called

"Little Peaches." The name describes one of the symptoms of the disease—the fruit remains very small, and ripens later than the normal

Fig 13.—Compressed Air Spraying Apparatus, showing the Spray.

ripening season. So far as known it is incurable. It is treated in the same way as Peach Yellows.

Recent investigations have shown that the New York Apple canker, which in cases is quite destructive to orchard trees, is caused by the same

fungus as that which causes the black rot of Apple fruit. The body blight of Pears is also shown to be due to the attacks of one or, possibly, more fungi. This is quite distinct from the fire blight, which is a bacterial disease. Progress is also being made in the study of root rot in certain orchard trees, and of the crown gall found in orchard and nursery. Experiments in the treatment of some of these troubles are under way.

The limitations of this discussion of recent developments in the treatment of diseases and insects injurious to orchard crops have prevented any detailed consideration of the topics which have been touched upon. Many things which seem to be of minor interest have necessarily passed unnoticed. The purpose of the writer has been to give a brief *résumé* of the development of modern orchard operations against insects and plant diseases, and set forth their present status in the orchard sections of the Eastern United States. It seems appropriate at the close of one century and the opening of another to set a stake to mark the present achievements in this line of horticultural progress.

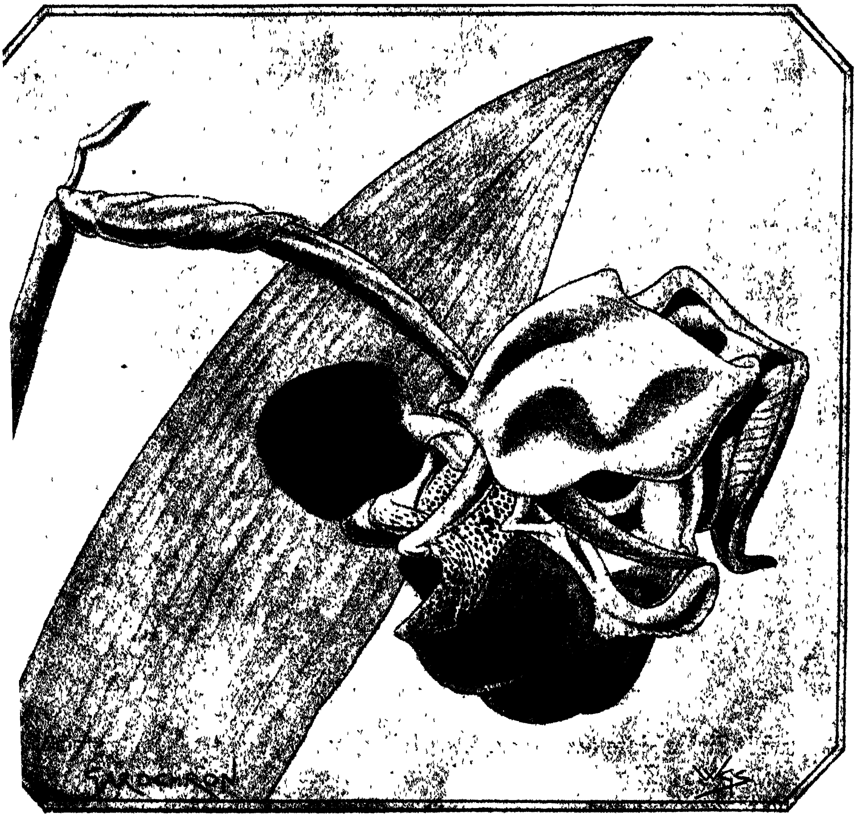


FIG. 14.—CORYANTHES MASTERSIANA. (*Gardeners' Chronicle.*)

FUMIGATION OF NURSERY STOCK.*

By Professor W. G. Johnson, U.S.A., formerly State Entomologist of Maryland, now Associate-Editor of the *American Agriculturist*.

A gas-tight house or room is the first thing necessary for the fumigation of nursery stock. The efficacy of the treatment depends upon keeping in all the death-dealing gas. The size and location of the building depend largely upon the amount of stock grown, and upon the character of the buildings near the packing sheds and "heeling-in grounds." In some cases a separate building is not necessary, as a corner of a shed or other inclosure can be cheaply converted into a suitable fumigating house. It would be useless to discuss in this article the reasons that have made it necessary to fumigate nursery stock for the destruction of various insect pests. As a matter of fact, most extensive fruit-growers hesitate about purchasing trees until such stock has a clean bill of health, and in many instances it is stipulated in the contract that they shall be fumigated with hydrocyanic acid gas. The cost of fumigation per 1,000 trees is less than 10*d*., including labour, chemicals, and extra handling. As a business proposition, many nurserymen are considering this, and advertise that they fumigate all nursery stock.

Construction of the House.

A room suitable for fumigating purposes will admit of no careless workmanship. Doors, ventilators, and windows should be tightly fitted. The timber should be carefully selected, especially the flooring used for lining. It should be as free as possible from knots. One of the largest fumigating houses known to me is 36 × 16 × 8 ft., with a roof pitch of 2 ft.,

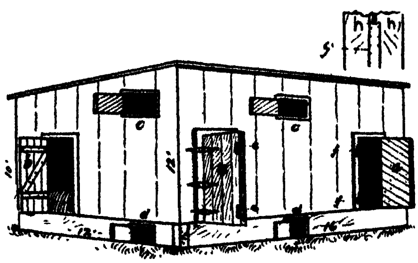


Fig. 15.—Outline of Model Fumigating House.

and is divided into two large rooms 15 × 14 × 7 ft., and two smaller rooms 4 × 5 × 7 ft. The flues, for ventilating purposes, lead out at the top of the roof and are so arranged they can be opened from the outside. There is also a small door, 2½ × 3 ft., on the opposite side of each room, which, when opened, insures quick ventilation.

First, a strong frame should be built and covered outside with 1¼ × 12 in. Va. pine boards, and ½ × 4 in. batten. The interior, including the

* Reprinted by permission from the *American Agriculturist*.

floor, should be lined with 2-ply cyclone paper, or other heavy raw-hide or building paper, over which a good quality of 4 in. flooring is laid. The roof may be covered with roofing paper, tarred or gravelled. In some cases shingles are used, and in one instance I know of a house where a galvanised roof is used. The doors should be $3\frac{1}{2} \times 6\frac{1}{2}$ ft., double, refrigerating style, hung with three heavy strap-iron hinges, and bolted at top and bottom with a lever such as is used on doors of refrigerators.

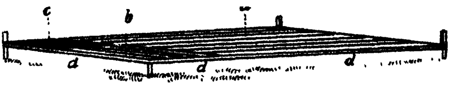


FIG. 16. PLAN OF SLAT FLOOR.

In most cases it is advisable to lock each door when the gas is being generated.

One of the most convenient and useful houses I have used has a ground plan of 12×16 ft. It is divided into three sections, one large room 12×12 and a small room 4×8 ft., with a store room 4×4 ft. The floor plan and general outline of this building are shown in figs. 15 and 17. It has a double floor with paper between, and a space of $1\frac{1}{2}$ ft. as shown in the figure, *d d*, above which there is a slat floor, on a level with the bottom of the door, as shown at *a* and *b*. In the store room, *c* (fig. 16), the floor is solid. In the construction of this building the slats should be made in sections, so they can be removed. It will be found necessary to clean the lower part of the house from time to time, as more or less dirt will rattle through the slats upon the floor. The slats are used so that the gas can be generated underneath the nursery stock, thereby obtaining a more general diffusion. The jar containing the chemicals

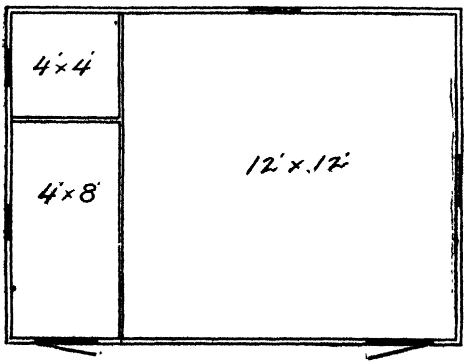


FIG. 17.—GENERAL PLAN OF FLOOR.

can be placed under the slats through the small doors at the base, *d d*, and very often it is advisable in a large room to have two doors of this character so that the chemicals can be divided and the gas generated on opposite sides. We have found that good results are obtained where this plan is followed. The small doors used for ventilation purposes, *c c* (fig. 15), can vary in size to meet the conditions. The door entering the store room need not be double, and 3×6 ft. is a convenient size.

Some nurserymen have rooms large enough to admit a wagonload of trees at one time.

In a case of this kind it is not necessary to have the slat floor, as the trees are loosely packed upon the wagon, and the chemicals are placed underneath the load. Where this house is used over 2,000,000 trees are fumigated annually.

Buildings of this character have been found very useful by nurserymen who have them. In one instance I know of a large nurseryman who uses his fumigating houses for storing Potatos during the winter. His rooms are built in a corner of his packing shed, and he informs me that he has no difficulty whatever in keeping Potatos perfectly in them.

Preparation of Trees for Fumigation.

Trees should be dug from the nursery and loosely packed in the house, either on end or flat on the floor. The chemicals are then prepared and placed as near the centre of the room as possible, or on opposite sides through the doors in the base, as shown at *d d*. The door should be closed and left for at least thirty minutes; this is the minimum limit, but thoroughly dormant trees are not injured, in the least, if left an hour or longer. Immediately after fumigation the house should be thoroughly ventilated and the trees removed, packed for shipment or heeled in.

The Chemicals Used.

1. Cyanide of potassium.
2. Sulphuric acid.
3. Water.

The cyanide must be practically chemically pure and guaranteed 98 to 99 per cent. It costs from 15*d*. to 18*d*. a lb., depending on quantity purchased at one time. I have found in my experience that the 25-lb. package is the most convenient, as it is put up in tin cans with screw tops, and can be conveniently handled by most nurserymen. I find that cyanide broken into lumps about the size of small hickory nuts gives the best results. It can be procured in small lumps by notifying the manufacturers in advance.

The best grade of commercial sulphuric acid, specific gravity 1·88, should be procured. Acid used in the manufacture of fertilisers, commonly called "chamber acid," should not be used. I have secured an excellent grade at a penny a lb. by the carboy. Of course, these chemicals are subject to changes in price.

It must be borne in mind that the acid cannot be placed in vessels of any kind, except those made of earthenware. I have found that an ordinary pickle jar or crock, holding from 2 to 4 qts., is best adapted for the chemicals. Sometimes a large snuff jar is needed in a large house. The cyanide should be weighed out and wrapped in strong paper bags, and kept packed in the can ready for use. A glass beaker, holding at least 8 oz., with the ounce mark on the side, for measuring acid and water, is very necessary. This method will not admit of any guesswork, and the chemicals must be prepared strictly in accordance with figures given for any enclosure. A bottle with glass stopper, or a chinaware pitcher, should

be kept on hand for the acid. With a pail of water and a tin cup the equipment is complete.

Making the Gas.

1. Measure the acid in the glass beaker and pour it into the jar. 2. Measure the water and pour this on the acid. 3. Drop in a bag of cyanide, bag and all, close the door quickly, lock it, and leave the desired length of time—half an hour or more, as above stated. In the meantime the foreman should see that nobody enters or loiters about the house, as the fumes are highly poisonous. One man should always be held responsible for fumigation of nursery stock, and keep time, so that the house can be opened and thoroughly ventilated later.

There is a slight formation of steam when the water is poured on the acid, but this is not dangerous. On the other hand, however, when the bag of cyanide is dropped into the liquids there is a bubbling and hissing similar to that produced by a piece of redhot iron in cold water. There is a dense cloud of so-called steam given off, which in itself is one of the most deadly, poisonous gases known to chemical science. It has an odour similar to that of peach kernels. The lungs once filled with it would produce instantaneous death. Therefore, do not stick your nose over a jar or in a house to test the gas. The residue in the jar should be emptied after each fumigation, and a new stock made up each time.

How to Estimate Chemicals.

Suppose we had a room containing 564 cubic ft., which we desired to fill with nursery stock and fumigate. I have found that 0·25 (twenty-five hundredths) gramme of cyanide per cubic ft. gives satisfactory results in all cases. To estimate the amount of chemicals necessary for this room multiply 564 by 0·25, thus: $564 \times 0{\cdot}25 = 141$ grammes of cyanide. To reduce this to ounces divide by 28·35, as there are 28·35 grammes in an ounce, thus: $141 \div 28{\cdot}35 = 5$ oz. (a fraction less), the amount of cyanide needed for this house.

My rule is to use a half more acid, liquid measure, than cyanide, and a half more water than acid. For this room we therefore needed 5 oz. cyanide, by weight, 7½ oz. acid, liquid measure, and 11¼ oz. water, liquid measure. I discard the fractions and measure the chemicals in round numbers. Any house or inclosure can be estimated by following this outline rule.

Effect of Gas on Nursery Stock.

I made a series of tests in '99, and determined the physiological effect upon various kinds and grades of nursery stock. I found that June buds and low-grade Peach, commonly called "whips," will not stand the gas stronger than 0·18 gramme per cubic ft. If low-grade Peach and June buds are to be fumigated the amount of cyanide used should be reduced to 0·16 or 0·18 gramme per cubic ft. Use the same strength for buds, grafts and scions, and do not leave them exposed longer than a half-hour.

I have found that the tender terminals of fully-matured first-class Peach were not injured in the least with 0·25 gr., even when they were

fumigated one hour. No injury was noticed to stock of this kind until the amount of cyanide was raised to 0·15 gr., and in this instance the terminals were only slightly injured. Apple was not affected, even when six times the normal strength was used, while Plum stood nearly three times the usual amount, and Pear from three to four times the normal dose.

Points to Remember.

In handling the cyanide, and in generating the gas, it must be borne in mind at all times that this chemical, which is white as snow and looks very much like lump sugar, is very destructive to animal life, and the gas generated from it, if inhaled, fatal in most instances.

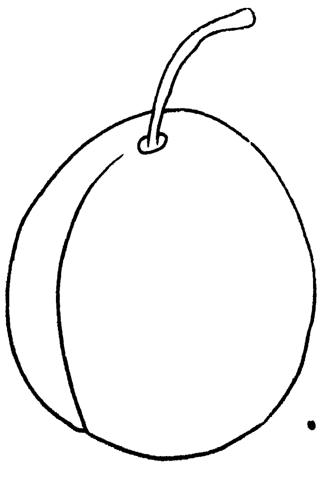
Cyanide should be carefully labelled "Poison," and kept out of the reach of children and other persons. It should not be exposed to air, as it will absorb moisture rapidly and be ruined.

Never fumigate a tree on which you know there are San José Scale. The furnace, and not the fumigating house, is the place for such trees. A dead Scale on a tree is just as demoralising to the nursery business as a live one, if the fruit grower sees it. Never fumigate peach a second time. It is not desirable to fumigate trees in a box car, after it is packed, as it is practically impossible to thoroughly ventilate such an inclosure afterward.

Trees should not be fumigated when they are drenching wet. They may be moist, even quite damp. The roots should not be puddled before the trees are fumigated. It should be borne in mind also that the nursery stock should be thoroughly dormant, otherwise unfolding buds will be injured. Fumigation, therefore, should be done late in the autumn and in the early spring as much as possible.

Never lose an opportunity to caution persons in your employ or on your place about the terrible danger of breathing this gas.

If all these precautions are regarded, there is not the least danger in handling this material, and nurserymen can rest assured that they have done all in their power, if the work has been properly conducted, to give the fruit grower all the protection possible.



EMORY FUMIGATOR FOR GROWING-TREES.

By Prof. W. G. JOHNSON, U.S.A.

In continuation of my last article on the fumigation of nursery stock by hydrocyanic acid gas, I will now describe its application to fruiting trees in orchards. In California the sheet tent is used almost universally, but in the East I have found a box tent very much more convenient and more easily handled.

The effectiveness of this gas depends largely upon the accuracy with which the cubic contents of the space is estimated. It is difficult to obtain, with exactness, the cubic contents of a loose tent covering a tree. To overcome this difficulty, I perfected a canvas or box-tent which I call the "Emory Fumigator," as shown in fig. 18. In my first experiments the boxes were constructed on a large scale, so as to cover trees varying from 15 to 20 ft. in height. These boxes were made with hoods which extended from 7 to 10 ft. above the top of the box. They were handled by means of the rigging shown in the figure, which illustrates the equipment in operation in a large Pear orchard.

It requires three or four men to operate an outfit of this kind, the help depending upon the number of fumigators in use. It requires one man to look after the chemicals and keep time, while two or three others are necessary in handling the boxes and rigging. The cost of the Emory fumigator depends upon the size. Those shown in fig. 18 are 6 ft. square at base and from 8 to 10 ft. in height, not counting the hood extension.

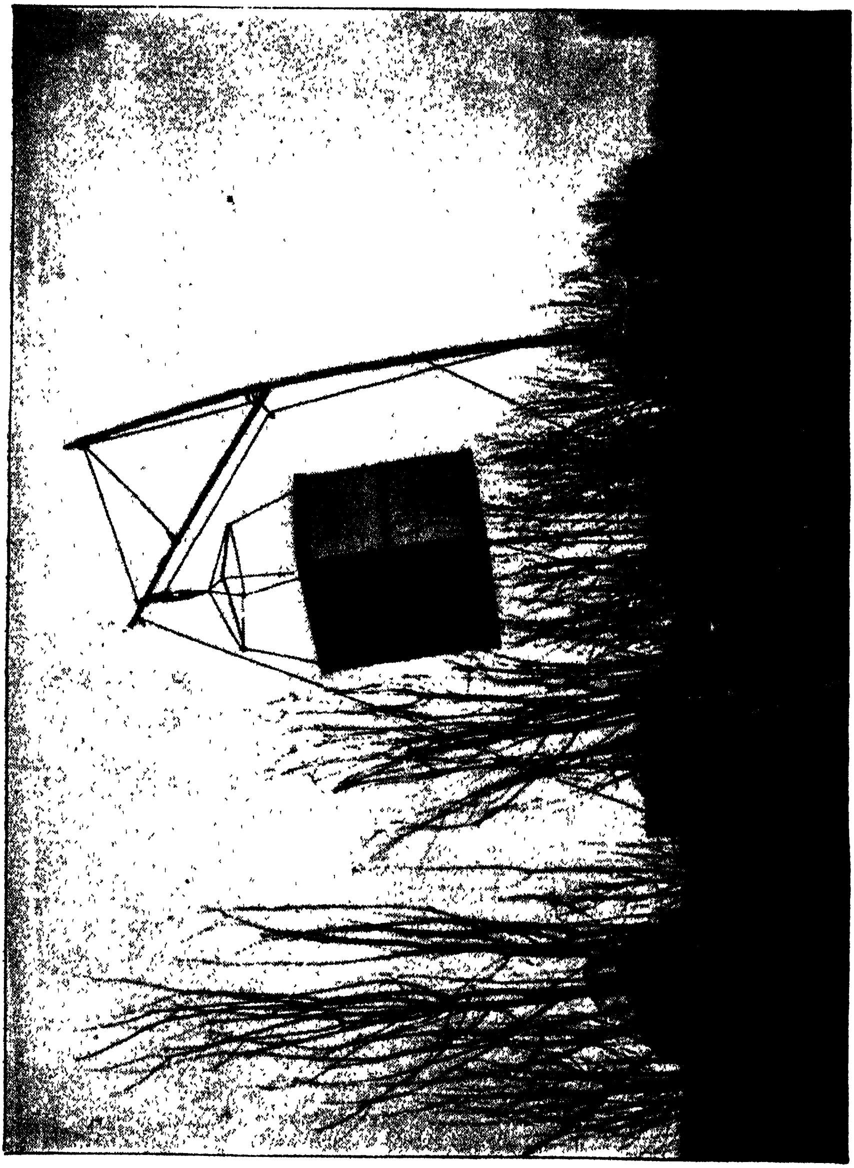
These boxes are made of eight-ounce cotton duck, such as used in the Army and Navy for tents and sails. The cloth is tacked over the four sections, the box being fastened together afterwards with screws. The hood is fastened securely around the top and is ready for use.

When trees are under 8 ft. in height a smaller box can be used to good advantage. A box 5 ft. square at base and 7 to 8 ft. high, with flat top, is perhaps the most useful in orchards for trees of this character. Fig. 19 shows an outfit of this kind in use in the heart of a block of 100,000 trees. In this equipment fifteen Emory fumigators were used, and 6,000 Japan Plum trees of various varieties and several hundred Peach trees were fumigated last autumn for about threepence a tree.

Three strips of ducking, each 20 ft. long, were felled together and securely fastened around a light wooden frame, another piece of cloth was then tucked over the top and around the edges, resulting in a gas-tight enclosure. Boxes of this character cost about £1 each. At the same time the cloth was not injured. After the duck was removed from the boxes it was used as wagon covers for hauling fruit. Tents or boxes made in this manner are given a heavy coat of boiled linseed oil. This makes them perfectly tight and more durable.

The chemicals used for the fumigation of orchard trees are the same as for nursery stock, the proportion, however, varying slightly. In the

nursery 0·25 gramme cyanide per cubic foot space enclosed is used, while in the orchard only 0·20 gramme per cubic foot is necessary. In estimating the chemicals, follow the instructions given in the last article for the fumigation of nursery stock, and heed cautions cited.



The cyanide is usually weighed in the orchard by one man. This is important, as this deadly poison should not be handled by any person other than the one familiar with it and who should be responsible for its use. The sulphuric acid can be kept in a carboy, drawn in small

quantities in a glass or china pitcher, and used as occasion demands. See that no acid gets upon the tent, as it will burn and ruin the cloth. The

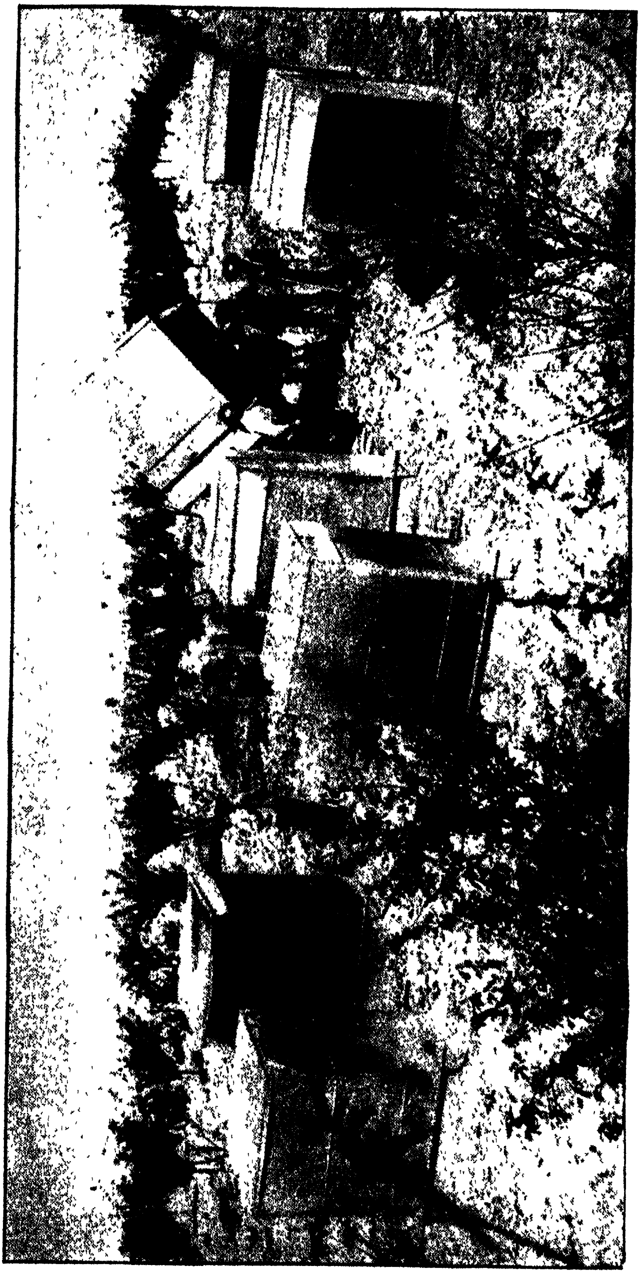


FIG. 19.—EMORY FUMIGATOR FOR TREES UNDER 8 FT. HIGH.

residue left in the jars after fumigation should be thrown close to the base of the tree, so that the persons handling the tents will not step in it.

Orchard trees should be fumigated in the spring before the buds open,

or late in the autumn after the function of the foliage has been performed. Fig. 19 shows an outfit at work October 26, 1900, at which time the trees had no further use for the leaves. No burning of the foliage was noticed on these trees, where the exposure was not greater than thirty minutes and gas generated from the 0·20 gramme formula. I do not advise the fumigation of trees in mid-summer or during the growing period. If it is found necessary to apply the gas during the summer months, it should be done at night. In California, large orange orchards are fumigated when in full fruit at night to avoid burning the foliage.

This method is not easily applied to very large fruit trees, but it seems to be the coming remedy for younger trees, especially those under 10 ft. in height, in orchards where the Scale has established itself. The work is quickly done and the cost of the equipment is not necessarily very great. A large Emory fumigator with hood will cost from £2 10*s.* to £3, while the rigging necessary for handling it costs about an equal amount.

THE BULBIFORM SEEDS OF CERTAIN AMARYLLIDEÆ.

By Dr. A. B. Rendle.

Some discussion having arisen as to the true character of these structures and their mode of germination it seemed worth while to look up the literature of the subject.

Paul Hermann, in his "Horti Academici Lugduno-Batavi Catalogus" (1687), p. 684, mentions them in *Crinum asiaticum* (which he calls "Lilium zeylanicum umbelliferum et bulbiferum"), as "semina fusca angulosa, quæ in bulbos grandescunt, conceptacula disrumpunt et germina protrudunt"; he says that the same "semina bulbacea" are to be observed in other "liliaceous" plants. Hermann gives a good figure which is reduced from an excellent drawing, No. 131 in his collection, now in the Department of Botany, British Museum.

A hundred years later Gaertner, in his "De Fructibus" (I. p. 42, t. xiii.), describes and figures fruits and seeds of *Bulbine asiatica*. There is some doubt as to the plant to which Gaertner refers. The large number of seeds in the ovary chambers precludes *Crinum asiaticum*, with which *Bulbine asiatica* has been considered synonymous. He states that the numerous flattened triquetrous seeds have a double integument, the outer of which is thick and "coriaceo-spongiosum," and include a fleshy endosperm and monocotyledonous embryo, which very soon grows out into a terete bulb-bearing shoot, so that the ripe capsule is often filled with germinating bulbils instead of seeds.

F. K. Medicus, in his "Pflanzenphysiologie-Abhandlungen" (1803) (II. p. 127), refers to a tuber-formation in the capsule of *Crinum bracteatum*.

In his "Prodromus" (1810), Robert Brown mentions the bulbiform seeds of *Crinum*, *Amaryllis*, and *Calostemma*, which, he says (p. 297), consist of a fleshy substance, often green outside, of a cellular nature and without spiral vessels, which, inasmuch as it is organic and grows by intussusception, can hardly be called albumen; within is a monocotyledonous embryo. In a paper on some remarkable deviations from the usual structure of seeds ("Trans. Linn. Soc." xii. p. 143), published in 1818, he again refers to them, but says: "On a more careful inspection, of those seeds at least in which the separation precedes the visible formation of the embryo, I now find very distinct spiral vessels—these enter at the umbilicus, ramify in a regular manner in the substance of the fleshy mass, and appear to have a certain relation to the central cavity where the embryo is afterwards formed."

But a far more complete account of these structures was given by a former Secretary of the Royal Horticultural Society, Richard Anthony Salisbury. Salisbury's great desire was to publish a "Genera Plantarum," but the work never appeared. At his death in 1829 he left a large quantity of MSS. and beautifully executed drawings, which are now in the Department of Botany at the British Museum. A fragment of the "Genera" was printed in 1866; it comprises a considerable portion of

the petaloid monocotyledons. Salisbury subdivides *Amaryllidaceæ*, as we now understand them, into a number of orders, one of which, *Amaryllideæ** (p. 120), is distinguished from all the others by characters of stamens and corolla, and, "what I deem most essential, in the bulbiform fleshy seeds, hitherto accompanied with a solid peduncle; so that when we cannot obtain the former, a tolerably good conjecture of their nature may be formed by the latter. These bulbiform seeds are often whitish or tinged with pink till exposed to the air, when they gradually assume a green hue, sometimes so dark as to be nearly black, but howsoever dark they may be always known by their thick fleshy coat hitherto in *Amaryllideæ* devoid of albumen; if only a few in each cell, they are generally large and irregularly shaped, not unlike small Potatos." He criticises Ker's suggestion as to their being an accidental and alternate mode of fructification, and says, "After a great

FIG. 20.—*Ammocharis falcata*, Herb, with a seed germinating in the capsule, April 26, 1814; the capsule was ripe in October and had stood all winter. To the left a germinating seed removed from the capsule.
(From a drawing by R. A. Salisbury, in the Department of Botany, British Museum).

many enquiries of our nurserymen and gardeners, I do not hesitate to reply, that all those species which have these bulbiform seeds never produce any other sort; neither are they peculiar to *Amaryllideæ*, but occur in the preceding as well as the following orders of *Pancrateæ* and *Strumareæ*; here, however, they begin and terminate for aught I know to the contrary." "With respect to their structure," he says, "many which I first dissected in 1790 at different periods of their growth, from the distinct vessels near their margin left no doubt in my mind that the great mass consisted of a thick fleshy coat." He also criticises Brown's statement that in some cases the seed separates before the embryo is formed; "many observations, lately repeated out of deference to his

* Comprises *Crinum*, *Ammocharis*, *Buphane*, *Amaryllis*, *Brunsvigia*, *Nerine*, *Lycoris*, *Hessea and Carpolyza*.

authority, convince me that these bulbiform seeds, so far from being detached before their embryo becomes visible, adhere to the dissepiments of the pericarpium till it is not only formed but very often sprouts." The radicular end of the embryo "is invariably directed towards the micropyle, but when the seed swells to a large size this is removed by dilation of the hilum to a considerable distance from the nourishing duct, being placed at the opposite end of the hilum as in *Leguminosæ*; and by the time many of these seeds are ripe, all traces both of micropyle and hilum, except the cicatrix of the nourishing ducts, nearly vanish; the original disc of the hilum is, however, often concave. After the radicle comes out of the fleshy coat at the micropyle, the facility with which it forces a passage through other substances is astonishing, rarely turning out of its way, but piercing an adjacent seed of the opposite cell in those capsules which do not

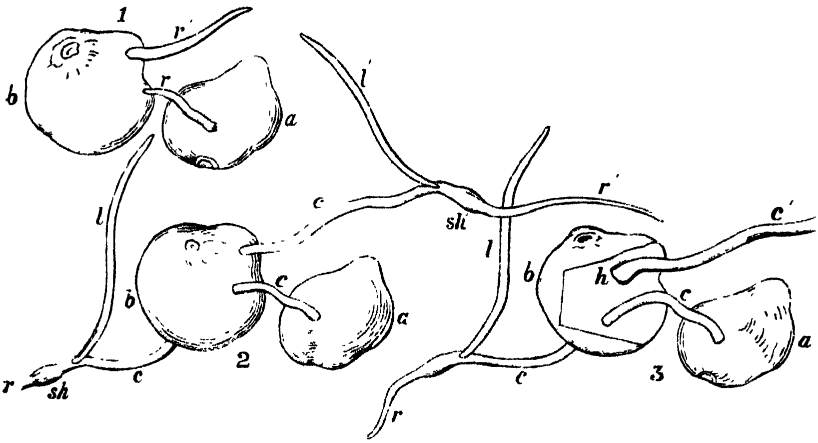


FIG. 21.—*Crinum longifolium*, Thunb. (*Amaryllis longifolia*, L.) Seeds germinating in a capsule which has been prevented from opening.
1. The radicle *r* of seed *a* has approached seed *b*.
2. The radicle and cotyledon of *a* have pierced *b*; the plumule, which has been carried through in the base of the cotyledonary sheath *sh*, is developing, the first leaf *l* having already emerged. The long cotyledon *c* still communicates with the seed from which it is absorbing nourishment. A precisely similar seedling is developing from *b*.
3. The same as 2, but the seed *b* has been cut open. Note at *h* the swollen sucker formed by the apex of the cotyledon.
(Copied from a drawing by R. A. Salisbury, now in the Department of Botany, British Museum.) (See Salisbury, *Genera Plantarum*, p. 122.)

split, or the membranous coat of the capsule itself (see fig. 21), apparently with as much ease as the lightest earth, and often in a direction contrary to gravitation. Any botanist desirous of seeing this need only to tie a piece of muslin round the capsule of *Amaryllis longifolia*, L., a little before it is ripe, and by placing that afterwards in any moist part of the stove, he will soon find the seeds sewed together by their radicles as completely as by a piece of string, see Tab. (fig. 21). Before the plumule or first leaf is evolved, an incipient bulb forms at its base, the outer coat of that being part of the cotyledon, to which physical law I know no exception, though the deity has probably ordained that no physical law shall be universal."

The figure to which Salisbury refers, and which was not published, I find among his drawings; it is reproduced above in fig. 21.

Although Brown and Salisbury were quite clear as to the true seed-character of these structures, it is evident that some divergence of opinion existed, for in 1824 Achille Richard, in a paper entitled "Observations sur les prétendus *bulbilles* qui se développent dans l'intérieur des capsules de quelques espèces de *Crinum*" ("Annales Sci. Nat." ii. p. 12), refers to the great number of authors who have spoken of fleshy bulbils developing in the interior of capsules and replacing the seeds in *Crinum*, *Amaryllis*, &c., and says that having had the opportunity of observing the pretended bulbils in *Crinum asiaticum*, *erubescens*, and *taitense*, he has assured himself of the error of the above statements. He gives a description (with figs.) of the structure of the seeds and the early stages of germination. He describes an integument (a sort of brownish epidermis, thick, dry and peeling irregularly) enclosing a thick

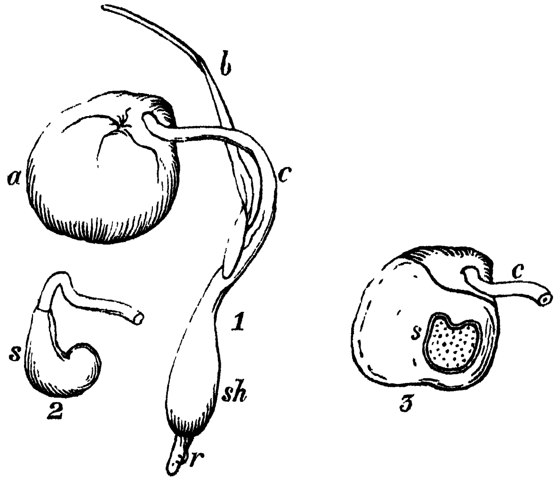


FIG. 22.—*Crinum longifolium*, Thunb. (*Amaryllis longifolia*, L.)

1. Seed germinating – *a*, seed ; *r*, radicle ; *c*, cotyledon ; *b*, first leaf ; *sh*, base of sheath of cotyledon which is already thickening to form the outermost bulb-scale, inside *sh* is the plumule.

2. Sucker, *s*, formed at the tip of the cotyledon by which the nourishment in the endosperm is absorbed for the benefit of the seedling.

3. Section of germinating seed showing the sucker, *s*, of the cotyledon lying in the endosperm.

(Copied from a drawing by R. A. Salisbury, now in the Department of Botany, British Museum.)

cellular endosperm, containing no vessels and becoming greenish towards the exterior, and a small embryo near the base of the endosperm. In germination the radicle makes its way out and grows downwards, soon drawing from the grain the cotyledon, which then elongates.

From the above notes we see that some discrepancy existed in the views held as to the nature of the fleshy substance surrounding the embryo. Brown finds that, in certain cases at any rate, it contains vascular tissue ; Salisbury also says that spiral vessels enter at the hilum, but are chiefly distributed along the margin of the fleshy mass, and that the great mass consisted of a thick fleshy coat. Richard, on the other hand, in the species of *Crinum* which he examined, refers the fleshy mass to endosperm.

The germination of the seed as figured by Salisbury (fig. 22) and Richard, and referred to by others, follows a course common to a number of monocotyledons. F. E. L. Fischer, for instance (in his "Beitrag. z. botan. System—Die Existenz d. Monocotyledonen und d. Polycotyledonen betreffend," published at Zurich in 1812), classes, from the point of view of their germination, *Crinum* and *Amaryllis* with fleshy seeds, with *Phœnix*

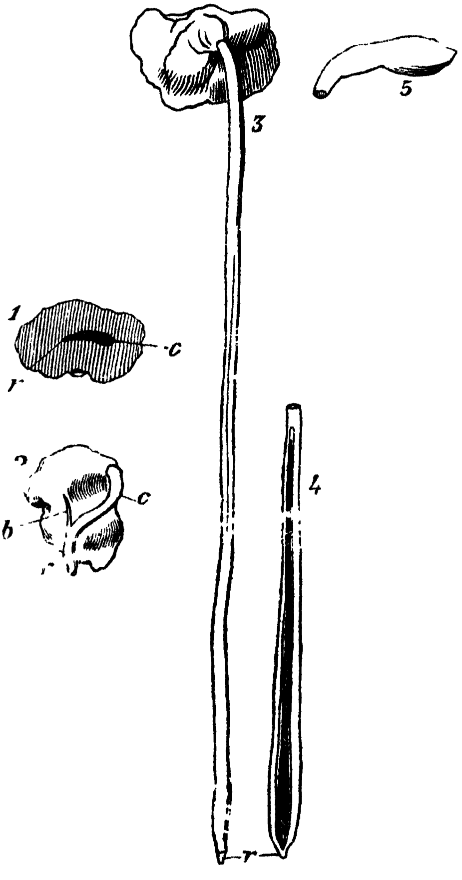


FIG. 23. *Crinum capense*, Herb.

1. Seed cut longitudinally, showing contained embryo—*r*, radicle; *c*, cotyledon
2. Germinating seed—*r*, radicle; *c*, cotyledon; *b*, first leaf of plumule.
3. A dry seed germinating on the edge of a board: the cotyledon has grown to a great length, the first leaf of the plumule has not yet broken from the cotyledonary sheath.
4. Longitudinal section of the cotyledonary sheath showing also the long, narrow first leaves of the plumule. The sheath which ultimately forms the outermost bulb-scale is already thickening.
5. Sucker-like end of cotyledon which remains in the seed.

(After H. C. van Hall, in "Tijdschr. v. Natuurl. Geschied." vii. t. iii. Leiden. 1840).

and other Palms, &c., and says, "The peripheral end of the cotyledon with the contained embryo protrudes from the seed and elongates worm-like, more or less, often for several inches. The radicle elongates in the same direction. . . . The place directly above the punctum saliens, where

development is going on [*i.e.* the base of the cotyledonary sheath surrounding the plumule] swells and takes on a bulb form."

In 1840 a Dutch botanist, H. C. van Hall ("Tijdsch. Nat. Geschied." vii. pp. 140-164), gave a full and well-illustrated account of the fruit, seed and method of germination in *Crinum capense.* He takes the same view of the structure of the bulbiform seed as did Richard (see p. 146); his figures (fig. 23) show well the elongation of the cotyledonary sheath carrying downwards the small radicle, the upper end of the cotyledon remaining in the seed to form a swollen sucker by means of which the nourishment in the endosperm is gradually absorbed. The plumule is surrounded by the base of the cotyledonary sheath, where the bulb very soon begins to develop, the sheath forming the outermost scale. His figures also illustrate the different length which the cotyledonary sheath attains under different circumstances. In one case where a seed was allowed to germinate on the edge of a board, and not supplied either with food or moisture, the radicle was carried vertically downwards by a cotyledonary growth six times the largest diameter of the seed in length, and still showed no trace of the leaf succeeding the cotyledon.

Later workers enable us to reconcile the differing statements as to the exact nature of the fleshy mass surrounding the embryo. In 1857 Henry Baillon ("Bull. Soc. Bot. Fr." iv. p. 1020) showed that in *Hymenocallis speciosa* the two integuments of the ovule after fertilisation become much thickened and fuse together with the nucellus to form the thick fleshy mass surrounding the embryo. Vascular tissue derived from the outer integument can be seen. In the next year Prillieux ("Ann. Sci. Nat." ser. 4, ix. (1858), 97) confirmed Baillon's statements on *Hymenocallis* (except that he states that the fleshy coat arises purely from the primine), but showed that in *Amaryllis Belladonna, Crinum erubescens, C. giganteum, C. taitense* and *C. capense* the *ovules are naked*, and that the fleshy coat is derived from a *large development of endosperm*, on the outside of which the remains of the nucellus forms a thin membrane. Moreover, no vascular tissue occurs in the fleshy coat.

A. Braun ("Ann. Sci. Nat." ser. 4, xiv. (1860), p. 9) shortly afterwards confirmed Prillieux's observations on the occurrence of *two* kinds of fleshy seeds, which he named *bulbous*, where the outer of the two integuments of the ovule forms the fleshy seed-coat (as in *Hymenocallis*), and *tuberculous* (as in *Crinum*, &c.) respectively. He also drew attention to the fact, noted by Brown, that in some of the fleshy seeds (those in which their separation precedes the visible formation of the embryo) spiral vessels do occur in the fleshy mass, though Brown had previously stated in the "Prodromus" (p. 297) that the mass was purely cellular. The recognition of the existence of the two kinds of seeds helped to explain these differences. Braun also noted that several embryos might occur in one seed in *Hymenocallis*.

A third kind of bulbiform seed was subsequently described by Baillon in an allied genus, *Calostemma*, in the "Proceedings of the Association Française" (Lyons, 1873). *Calostemma* was one of the Australian genera to which Brown referred in his original note in the "Prodromus." In *C. Cunninghami* each of the three ovary-chambers contained two anatropous ovules, the development of which Baillon found to be at first

quite normal; two integuments enveloped the nucellus, in the centre of which was apparently an embryo-sac. But instead of producing a seed, the ovule developed directly into a bulbil in the following manner (fig. 24). It became very much swollen at the base (*chalaza*), forming a disc-like structure, from the centre of which a root grew outwards and a conical bud inwards, occupying the central ovular cavity and growing up towards the micropyle. At the same time the integuments became fleshy, and formed, together with the remains of the nucellus, the outer scales of the bulbil. Finally Goebel, in his "Pflanzenbiologische Schilderungen" (i. p. 129) (1889), has given a detailed account of the development of the seed in *Crinum asiaticum*. The ovules, of which there are two in each of the three ovary-chambers, recall in their extremely rudimentary structure

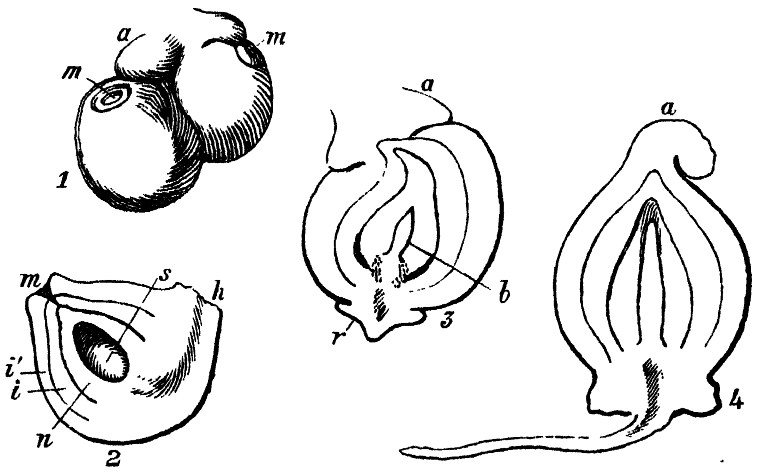


FIG. 24.—*Calostemma Cunninghami*, Ait.

1. Two anatropous ovules *m*, micropyle; *a*, an aril-like outgrowth which ultimately forms a cap on top of the bulb.
2. Longitudinal section of one of the ovules shown in 1, showing the inner, *i*, and outer, *i'*, integuments surrounding the nucellus, *n*, in which is seen the embryo-sac, *s*; *m*, micropyle; *h*, hilum, or point of insertion of the ovule.
3. Longitudinal section of an ovule at a later stage—the base (chalaza) has become flattened, forming a disc, from the lower part of which a root, *r*, is growing, from the upper a bud, *b*, which is filling the cavity of the embryo-sac.
4. Mature bubil in longitudinal section. The bud has completely filled the cavity of the nucellus, the remains of which, together with the integuments of the ovule, form the bulb-scales.

(After Baillon, in Compt.-Rend. de la 2me Session, Assoc. Franc. [1874], t. iii.)

those of parasitic plants. They are naked, consisting merely of an elongated swelling on the placenta, in the centre of which is an embryo-sac (sometimes two embryo-sacs occur in one ovule). After fertilisation the embryo-sac becomes filled with endosperm, in which the small embryo is enclosed; occasionally a central narrow space remains in the endosperm, which Goebel suggests may be the central cavity referred to by Brown in those seeds in which he found no embryo, the latter from its small size having been overlooked. The endosperm continues to develop, growing out of the nucellus (of which only a small portion remains at the base), and forms a large fleshy mass, completely surrounding the small axial embryo. This growth in thickness takes place chiefly on the outside,

where we find chlorophyll developed in the cell-layers. Ultimately a thin protective coating of cork is formed. Thus the ripe seed consists simply of a mass of endosperm enclosing an embryo. The endosperm forms a soft fleshy mass, in which are air-containing intercellular spaces, forming, as Goebel suggests, an adaptation for the distribution of the seeds by water, their specific gravity being thereby considerably reduced. The peripheral cork-layer prevents water-logging. A similar device occurs in some Water Lilies, where an additional seed-coat (the aril) forms a light air-containing float.

To sum up the results of previous work on the bulbiform seeds of *Amaryllideæ*, we find that three forms can be distinguished, as follows :—

A. *True seeds.* 1. Developed from a normal ovule, the outer integument of which becomes thick and fleshy after fertilisation, and forms the substance of the bulbiform mass, *e.g. Hymenocallis.*

2. Developed from a naked ovule, the fleshy substance being derived entirely from the endosperm, which develops chlorophyll in its outer layers and continues to grow for some time, *e.g. Crinum asiaticum*, and other species.

B. *A vegetative growth replacing the seed.*

3. A normal ovule is produced, but a viviparous growth of an adventitious shoot and root takes place at its base, and a true bulbil is formed, the ovule integuments forming the outer coats, *e.g. Calostemma Cunninghami.*

As regards germination, events seem to follow a course common to many bulb-forming Monocotyledons (see for instance, Lubbock's "Seedlings," ii. p. 578). The radicle is pushed outwards and downwards by the growth of the cotyledon, in the sheathing base of which the plumule is protected; the tip of the cotyledon remains in the seed, acting as a sucker to absorb the nutritive endosperm. The formation of the bulb is soon indicated by the swelling of the base of the cotyledon-sheath, which forms the outermost bulb-scale. Under some circumstances the cotyledon may reach a considerable length before the plumule shows any sign of breaking through at its base.

HYBRID CONIFERS.

AN ADDRESS TO THE SCIENTIFIC COMMITTEE AT THE OPENING OF THE SESSION, FEBRUARY 12, 1901.

By MAXWELL T. MASTERS, M.D., F.R.S., Correspondent of the Institute of France.

BY the courtesy of M. Philippe de Vilmorin I am enabled to lay before the Committee cones and foliage of a remarkable hybrid raised in 1867 by his father, the much lamented Henry de Vilmorin, between *Abies Pinsapo* and *A. cephalonica.*

Before alluding to this tree in detail it may be convenient if a summary of our existing knowledge of hybrid Conifers be given.

Hybridisation between the species of Conifers is, in spite of the profusion of pollen that is produced, not of common occurrence. This is not to be wondered at, as in the Old World, at any rate, the species rarely grow intermixed, and the great forests are composed of one species only. Nevertheless, it is conceivable that in mixed plantations and Pineta cross fertilisation and even hybridisation may occur.

Focke, in his "Die Pflanzen-Mischlinge," Berlin (1881), page 419, cites the following real or reputed hybrids:—

Pinus montana × *P. silvestris.*—This grows in Southern Bohemia and in the Grisons, in company with its assumed parents. This is the *P. rhætica* of Brugger, to which also *P. uliginosa* and *P. obliqua* may probably be referred.

Pinus Laricio subsp. *nigricans* × *silvestris*, according to Klotzsch, was raised artificially in 1845.

Pinus leucodermis, Antoine, is said by Purkyne to possess the cones of *P. silvestris* and the male flowers of *P. Laricio*, whilst *P. Neilreichiana* has male flowers like those of *P. silvestris.*

Pinus Brutia of Tenore is, according to Purkyne, an intermediate form between *P. Laricio* and *P. halepensis.*

The above-mentioned hybrid between *Abies Pinsapo* and *A. cephalonica*, raised by M. Henry de Vilmorin, is also cited by Focke. To this further reference will be made later on.

Mr. Kent, in the latest edition of Veitch's "Manual of the Coniferæ" (1900), page 45, mentions the following:—

Abies Pinsapo × *A. Nordmanniana*, "Revue Horticole" (1890), page 231.

Abies lasiocarpa × *A. amabilis*, Sargent, "Silva of North America," xii. 126.

Pinus Thunbergi × *P. densiflora*, Mayr, "Abietineen des japanischen Reichs," 83.

Pinus silvestris × *P. montana*, "Flora helvetica," xlvii. 145.

Abietia (*Pseudotsuga*) *Douglasii* var. *Standishii* × *Abies pectinata*, Gordon, "Pinetum," edition 2, page 26.

YEW (TAXUS) and CEPHALOTAXUS.—A possible hybrid between these

two genera occurred in the nurseries of Messrs. Paul & Son, of Cheshunt, among some Yews, but unfortunately no record was taken, and the plant is no longer in existence in the nursery.

In the genus JUNIPERUS the following supposed hybrids occur:—

Juniperus communis × *J. sabinoides* = *J. Kanitzii* ×, Csato', ex Wettstein in "Sitzb. Wien. Acad." xcviii. (1887), 333; Kerner, "Natural History of Plants," English edition, ii. 565. This form was found in Transylvania.

J. communis × *J. nana* = *J. intermedia*, Schur, Wettstein, *loc. cit.* 332.

Wettstein considers that the differences in the minute anatomical construction of the leaf in the Junipers above mentioned, as also in *Pinus Neilreichiana* × *P. rhætica*, are sufficiently marked to be used as diagnostic characters between them and their reputed parents. This conclusion, however, is not endorsed by M. Joseph Erb, who has had the opportunity of studying them in Switzerland.* I have no personal knowledge of any of these alleged hybrids; but with regard to *Juniperus intermedia*, which is supposed to be a cross between *J. communis* and *J. nana*, I may point out that intermediate forms between these two are not at all uncommon, and have been mentioned by various observers, who have not attributed these variations to hybridisation. I myself found in 1900, on the Wengern Alp above Lauterbrunnen, a shrub, the lower branches of which were spreading and even prostrate, with short, relatively obtuse thick leaves, as in *J. nana*; whilst the central branch was erect, and its subdivisions bore numerous flat, thin, sharply-pointed leaves, more like those of the ordinary *J. communis*.

THUYA: *Biota meldensis* is a form first found in a cemetery near Meaux, in proximity to bushes of *Thuya orientalis* and *Juniperus virginiana*. It was in consequence considered to be a hybrid between those two species,† but there seems little doubt that it is a stage of growth of *T. orientalis*, analogous to those forms of Cupressus, Juniperus, and Thuya which have been included in the spurious genus *Retinospora*.

In the "National Nurseryman," published at Rochester, U.S.A., under date of February, 1900, p. 4, a "new evergreen" is described under the name of the "Rosedale hybrid." It is said to have originated in the Rosedale Nurseries, Washington County, Texas, as a cross between the Golden Arbor Vitæ (*Thuya orientalis* var.) and *Retinospora squarrosa* (= *Cupressa pisifera* forma *squarrosa*). "It has the same dense, compact, upright and uniform growth as the Golden Arbor Vitæ, while in texture and colour it resembles the Retinospora, except that it is soft and feathery to the touch. In colour it is a bright fresh pea-green, very striking and attractive."

* Wettstein, "Ueber die Verwerthung anatomischer Merkmale zur Erkennung hybrider Pflanzen," in *Sitzb. d. Kais. Acad. d. Wissenschaft*, Wien, December (1887); Abtheilung i. Erb in *Bericht der Schweiz. botanischen Gesellschaft*, Heft vii. (1897).

† Carrière, *Traité Général des Conifères*, ed. 2 (1867), p. 103, who describes the plant, does not share this opinion. See also Gordon, *Pinetum*, ed. 2 (1875), p. 57. This last-named author considers it a "very doubtful hybrid." Beissner, *Handbuch der Nadelholzkunde* (1891), p. 58, speaks of it as a transitional form of *Biota orientalis* ("Uebergangsform"). Kent, in Veitch's *Manual of the Coniferæ* (1900), p. 249, refers to it as a variety of *Thuya (Biota) orientalis*.

PINUS: The following hybrids have been recorded, in addition to those mentioned by Focke, p. 97:*—

Pinus nigra × *P. silvestris*=*P. Neilreichiana* ×, Reichardt in "Verhandl. der zoologis.-botanisch. Gesellsch.," Wien, xxvi. (1876), 461; Halácsy und Braun, "Nachträge zur Flora von Niederösterreich," 65. *P. silvestri-Laricio*, Neilrich in "Nachtrag zu Maly's Enumer.," 68 (1861). Found near Voslau and Grossau, in Lower Austria. The *Pinus nigra* here mentioned is *P. Laricio* var. *austriaca* of Endlicher, the *P. Laricio* var. *nigricans* of De Candolle.

Pinus silvestris, L. × *P. nigra*, Arn.=*P. permixta*, Beck in "Abhandlungen der k. k. zoologisch-botanischen Gesellschaft," Wien (1888), 766, and in "Niederösterreichische Nadelholzer in Blätter des Vereines für Landeskunde von Niederosterreich" (1890), 66.

Pinus silvestris, L. × *P. uliginosa*, Neum.= *Pinus digenea*, Beck in "Annalen des k. k. Hof-Museums," iii. (1888), 77, and in "Niederosterreichische Nadelholzer in Blätter des Vereines fur Landeskunde von Niederösterreich" (1890), 63.

Pinus montana, Miller × *P. silvestris*, Linn.= *P. rhætica*, Brugger in "Schweiz Flora" (1861), 150.

Pinus uncinata, Ram. × *P. engadinensis* = *P. Heerii*, Brügger in "Jahresbericht der Naturforscher-Gesellschaft," Graubundten, xxix. 130.

P. silvestris x. *hybrida*, Heer in "Verhandlungen der Schweizerischen Naturforscher-Gesellschaft" (1862).

P. humilis, Link × *P. silvestris*, Linn. f. *submontana* = *P. pyramidalis*, Brugger, *loc. cit.* 130.

P. humilis, Link × *P. silvestris*, L. var. = *P. Christii*, Brugger, *loc. cit.* 131.

P. nigra × *P. montana* = *P. Wettsteinii*, Fritsch in "Oesterreichische botanische Zeitschrift" (1889), 108.

Pinus digenea, Wettstein nec Beck. See also Beck in "Wiener illustrirte Garten-Zeitung," vol. xvii. 228.

P. halepensis × *Pinaster*, G. de Saporta in "Comptes-Rendus" (1899), cix. 656, ex Beissner, "Handbuch," 224.

Other supposititious hybrids are mentioned between *P. nigra*, Arn. and *P. montana*, Miller, and between *P. uliginosa* × *P. pumilio*.

THE DOUGLAS FIR.—In Gordon's "Pinetum," 2d. edition (1875), p. 26, mention is made of a very remarkable variety of the Douglas Fir (*Pseudotsuga Douglasii*). It was first observed by the late Mr. Standish, in his nursery at Bagshot, among some seedlings gathered from a Douglas Fir in close proximity to some large Silver Firs. Mr. Gordon, judging from the tenor of his remarks, must have seen this tree, which he says was 10 to 12 feet high in 1861, and alludes to it as an accidental seedling variety, or "probably a hybrid between that kind and the Silver Fir, as its general appearance and history would seem to indicate." I have lately made enquiries as to the existence of this tree, but without success, Mr. Standish's successors being unable to trace it.

ABIES = Silver Fir.—M. Croux produced in his nurseries near Sceaux in 1871–1872, a hybrid Abies, to which the name of *Abies Nordmanniana*

* G. Beck, "Uebersicht der hybriden Pinus-Arten," in *Wiener illustrirte Garten-Zeitung* (1890), 226.

speciosa was attached.* Pollen from *A. Pinsapo* was, in this instance, placed on the female flowers of *A. Nordmanniana*, care having been taken to remove all the male flowers from the last-named plant, so that it might not be fertilised by its own pollen. By the kindness of M. Croux and of M. André, I have received a specimen of this hybrid, the leaves of which are intermediate in appearance between those of its parents, the leaves having the general appearance of those of *A. Nordmanniana*, but shorter, thicker, and acutely pointed, as in *A. Pinsapo*. The resin canals

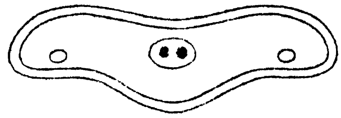


FIG. 25.—PLAN OF LEAF SECTION, M. CROUX'S HYBRID.

are sub-epidermal, as in *A. Nordmanniana*. M. Bailly gives a full description of this hybrid in the "Revue Horticole"; as also of a second plant, which has been called

Abies insignis.—The history of this tree is as follows. In 1848 or 1849 a graft of *Abies Pinsapo* was grafted on to a stock of the Silver Fir, *Abies pectinata*, in the nursery of M. Renault, of Bulgnéville (Vosges). In due time cones were produced on the grafted plant, and these yielded seed. The seeds were sown and seedlings appeared, one half of which were like those of *A. Pinsapo* and the remainder were intermediate between *A. Pinsapo* and *A. pectinata*. In subsequent years the resemblance in the seedlings to *A. Pinsapo* decreased, whilst the proportion of the intermediate forms increased.† It was at first supposed that the variation was a result of graft-hybridisation, but the presence at no great distance of a tree of *Abies Nordmanniana*, which is known to have borne male flowers, renders it more than probable that the hybrid character of the seedlings was the result of a cross from *A. Pinsapo* by *A. Nordmanniana* rather than the result of graft-hybridisation.

M. Bailly, who has grown seedling plants from both these sources, remarks on the vigorous growth that they make and on the great similarity that exists between the seedlings of the two plants. In both the habit, ramification, colour, and arrangement of the leaves recall *A. Nordmanniana*, but the thickness of the leaves and their leathery texture are more like those of *A. Pinsapo*. The direction of the branches is intermediate between that of the two parents, less spreading than in *Pinsapo*. The extremity of the leaf is not acuminate or mucronate as in the mother, nor is it truncate and notched as in the father; it is, in fact, subacute or obtuse.

Since this paper was originally laid before the Committee M. Moser, of Versailles, has kindly forwarded me a series of specimens representing hybrid Conifers raised by him in 1878. These consist of four different forms, all raised from *Abies Pinsapo*, fertilised by the pollen of *Abies Nordmanniana*, the reverse cross to that effected by M. Croux, and one of special interest, the result of the crossing of the Japanese *Picea ajanensis*

* *Revue Horticole*, May 16, 1890, p. 230. † *Revue Horticole* (1879), p. 444.

by the pollen of the North American *Picea nigra Doumeti*. Of the four hybrid Abies I append the following descriptions:—

(1) A handsome form, having something of the aspect of *A. cephalonica*. The bark of the shoots is fawn-coloured, with a few blackish setæ. The herbaceous shoots are angular, green, with a few fawn-coloured scaly hairs. The bud scales are coriaceous, brown, ovate-acute, compacted into a tubular sheath. Leaves densely arranged in numerous rows, all upturned and nearly equal in length, as in *A. Pinsapo*. The leaves in the middle of the shoot measure about 23 mill. by 2 in width; each leaf is linear-acute, flattish green, and slightly grooved on the upper surface, with a few stomata near the tip; lower surface silvery, with a prominent midrib between several bands of stomata. The resin canals are peripheral.

(2) Of the same origin as the other four this has, so far as the branch before us is concerned, the appearance of that of the common Silver Fir, the leaves being apparently of unequal length, few-ranked and subdistichous. The shoots are smoky brown, the herbaceous shoots green, covered with fawn-coloured scaly hairs. The bud-scales are persistent at the base of the young shoots, leathery, brown, ovoid-acute, and compacted into a tubular sheath, through which the shoot protrudes. Leaves in several rows, forming a more or less flat surface, spreading, scarcely upturned, of unequal length, those in the upper or central portion shorter than the others, so that the passage of light to the underlying leaves is the less obstructed. The larger leaves measure approximately 18 by 2 mill., they are linear-subacute, or sometimes obscurely notched at the tip, green and slightly grooved above, midrib prominent on the under surface between several rows of stomata.

(3) This specimen has something of the habit of *A. Pinsapo*, but with short flat leaves. The bark of the shoot is fawn-coloured and glabrous, the herbaceous shoots are greenish, angular, thinly clad with brownish scaly hairs. The bud-scales are leathery, brown, ovate-oblong, and form a tubular sheath through which the growing shoot passes. The leaves are in many rows, the lateral ones spreading, secund, the median ones slightly ascending, not appressed, and directed towards the tip of the shoots. The individual leaves from the centre of the shoots measure approximately 12 mill. in length by 2 mill. in width, and are flattish, linear-oblong obtuse, grooved on the upper surface, and with a prominent midrib between two bands of stomata. The resin canals are sub-epidermal.

(4) A handsome form with the general aspect of *A. cephalonica*. The branches are fawn-coloured; the herbaceous shoots olive-coloured, angular, with brownish scaly hairs. Leaves loosely arranged in many rows, all spreading, those in the middle nearly as long as the lateral ones, ascending, not appressed, those on the centre of the shoots about 22 mill. long by 1 mill. in breadth, linear-acute, green on the upper surface, silvery beneath, with a raised midrib between two bands of stomata, each band containing about eight rows. This specimen bore the remains of male flowers, surrounded at the base by overlapping ovate-acute, ciliate, reddish, boat-shaped bud-scales; rachis slender; filaments remote filiform; anthers two-lobed obtuse.

In all the above cases we have the same or very closely allied species involved, viz., *Abies Pinsapo*, with its blunt leaves arranged on all sides of the stem and all nearly of the same size, and *A. Nordmanniana* (perhaps a form of *A. excelsa*), and nearly allied to *A. cephalonica*. In all these trees the flat leaves are nearly in one horizontal plane, or the median and uppermost leaves are upturned, sometimes all nearly equal in length, or the upper ones shorter than the lower ones.

Professor Sargent's account of the supposed hybrid between *A. lasiocarpa* and *A. amabilis* runs as follows :—

"On a ridge of the Olympic mountains separating the waters of the Soldue from those of the Quillihute, I found on August 19, 1896, at an elevation of four thousand five hundred feet above the sea, an Abies of

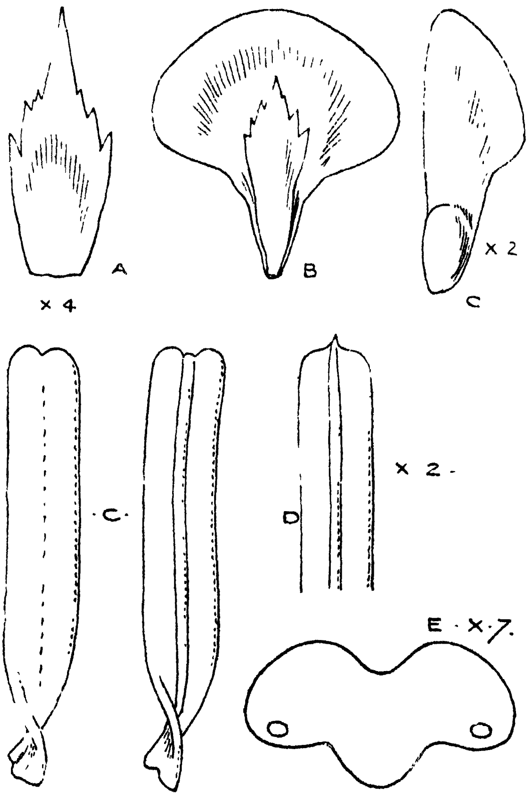


FIG. 26.— PROFESSOR SARGENT'S HYBRID ABIES.
A, bract; B, bract with scale; C, seed; C, D, leaves; E, leaf section.

from sixty to eighty feet in height, growing with *Abies lasiocarpa* and *A. amabilis*, with the slender spire-like head and the foliage of the former and the cones of the latter. It was, perhaps, a natural hybrid between these species." Sargent, "Silva," xii. 126 *adnot.* (1898).

PICEA: The only hybrid known to me in this genus is the one for specimens of which I am indebted to M. Moser, and which I received from him under number "5." See (fig. 29) p. 105.

This is a very interesting cross between the flat-leaved *Picea ajanensis* (figs. 27, 28), fertilised by the pollen of *Picea nigra Doumeti*. The habit, so far as can be seen from the shoot, is that of *P. ajanensis*, the branches convex from the base to the depressed tips, and the central or uppermost

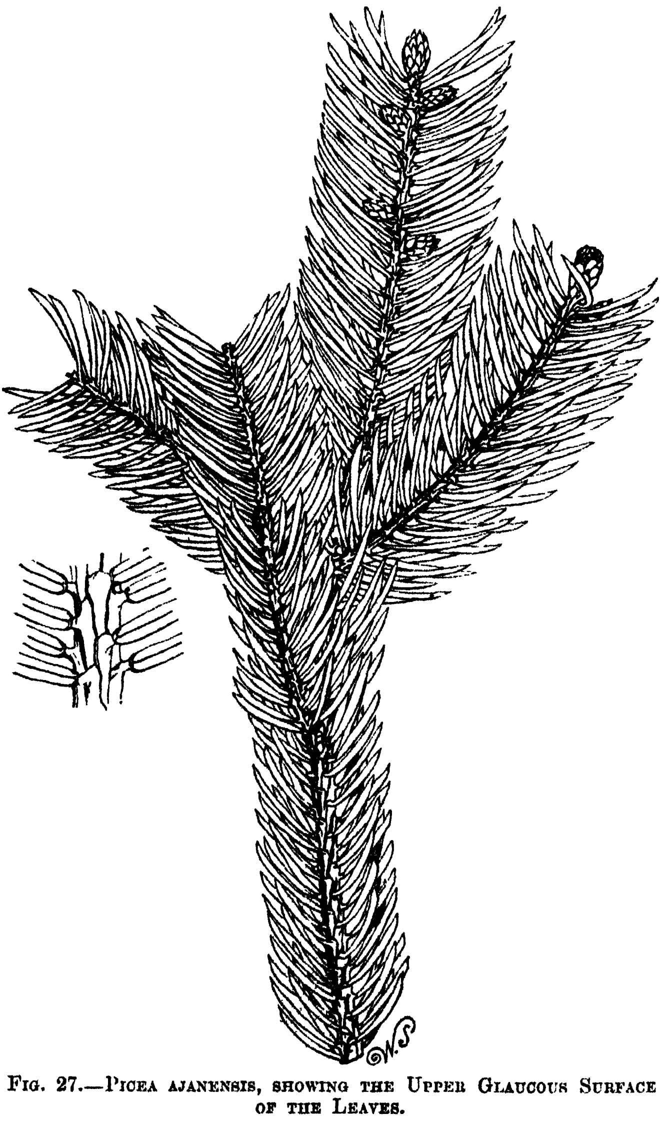


FIG. 27.—PICEA AJANENSIS, SHOWING THE UPPER GLAUCOUS SURFACE OF THE LEAVES.

leaves appressed. The bark is brown or fawn-coloured with prominent "pegs" or pulvini, as in the true Spruces. The herbaceous shoots are glabrous, angular, greenish or olive-coloured. The leaves are densely arranged in many rows, secund, subequal, the lateral ones forming an acute angle with the shoot that bears them, the upper or median leaves convex, nearly of the same length, slightly appressed, and with their points directed to the tips of the branches.

The individual leaves measure about 16 mill. in length, are 4-angular in section, each linear mucronate, with the lower surface convex and green, the upper surface, as in *P. ajanensis* and some Junipers, having the stomata on the silvery upper surface.

FIG. 28.—PICEA AJANENSIS, SHOWING THE LOWER GREEN SURFACE OF THE LEAVES.

The bud-scales at the base of the herbaceous shoots are coriaceous, brown, oblong-subacute, with membranous edges, forming a tubular sheath through which the growing shoot pushes its way.

M. DE VILMORIN'S HYBRID ABIES.

Doubts as to the hybrid character of some of the Conifers before mentioned may be entertained. In the trees raised by M. Croux and by M. Moser conjecture gives place to certainty. We have also the direct

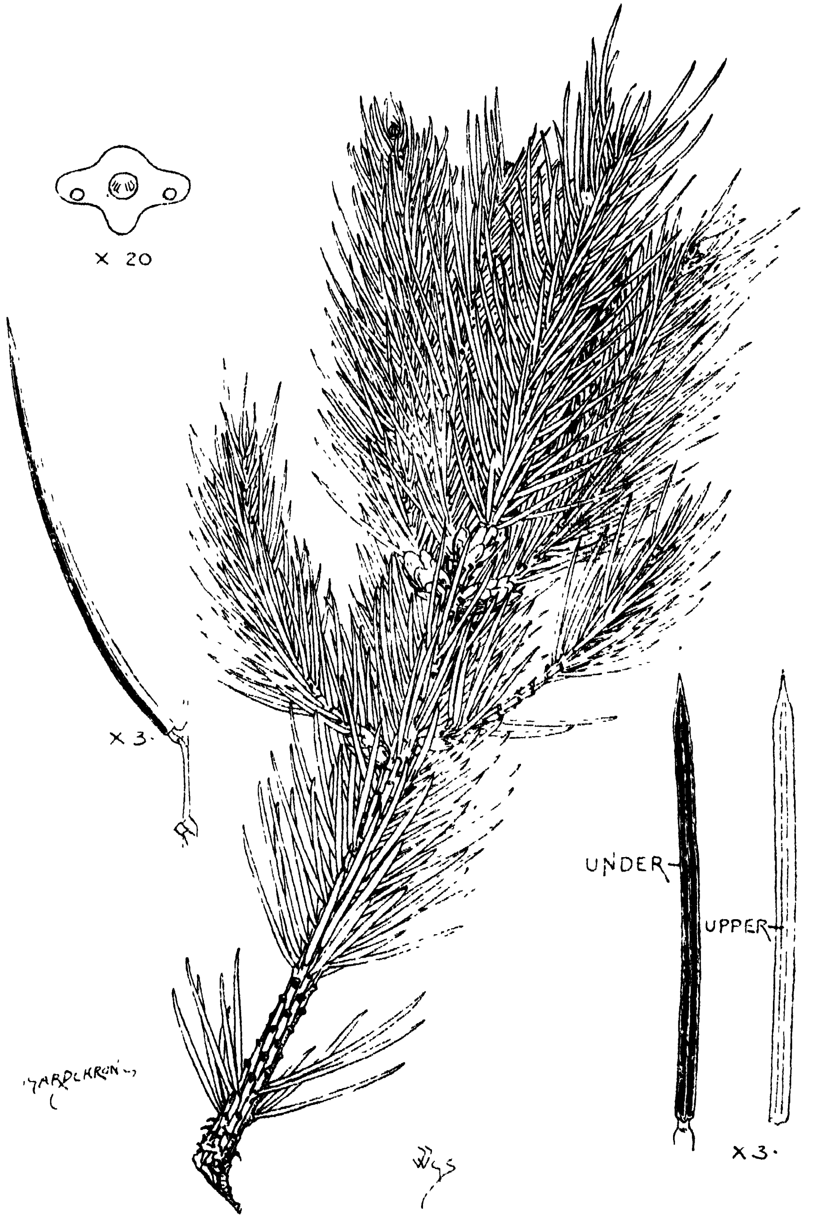


FIG. 29.—PICEA MOSERI ×, SHOOT AND LEAVES, SHOWING BOTH SURFACES AND SECTION.

evidence of our late friend Henry de Vilmorin as to the tree raised by him. This tree exists in his garden at Verrières, where it has been seen by numerous botanists, and where I also saw it in 1895. And now thanks

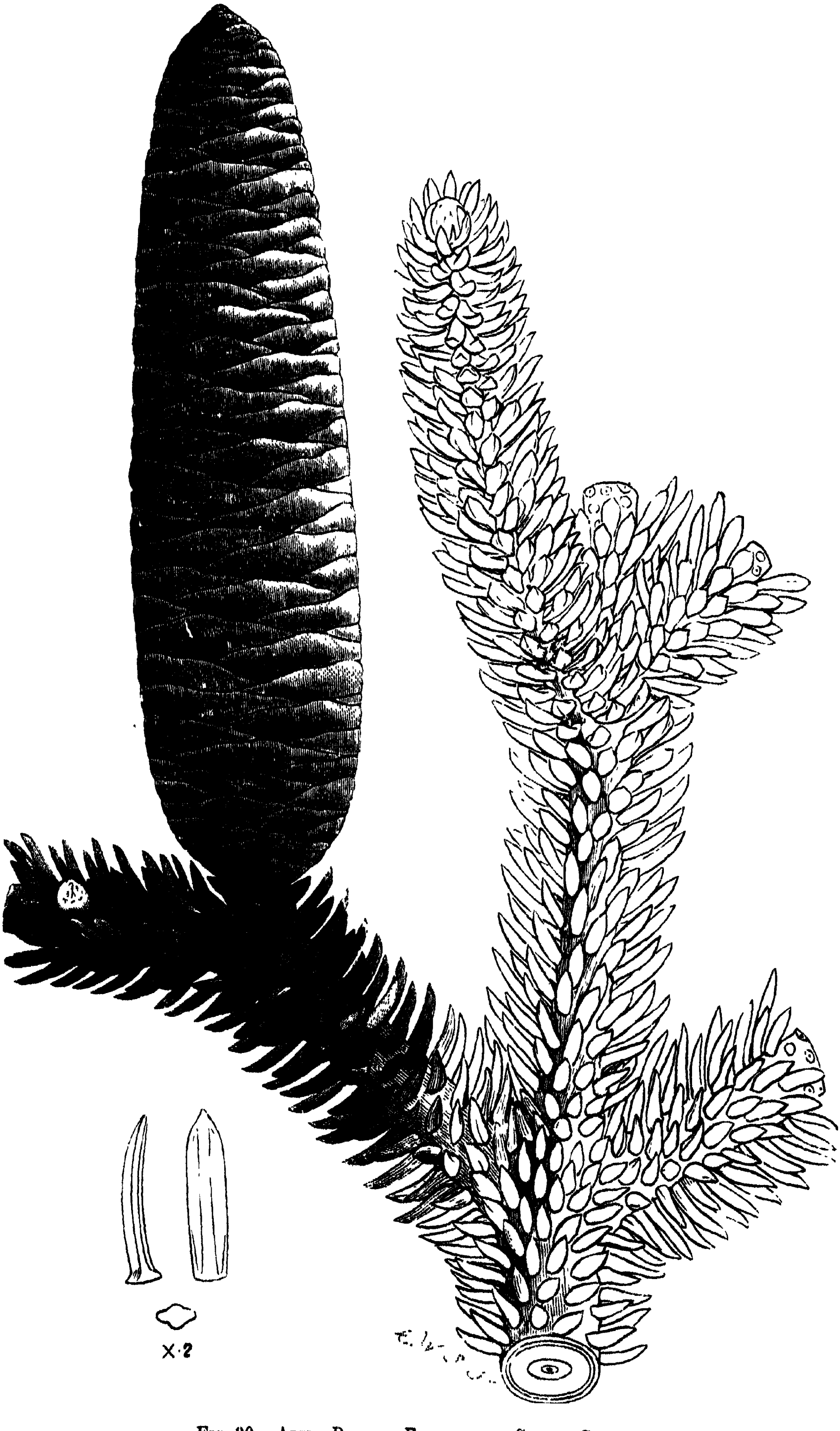


Fig. 30.—Abies Pinsapo, Foliage and Single Cone.
The female parent of M. de Vilmorin's hybrid.

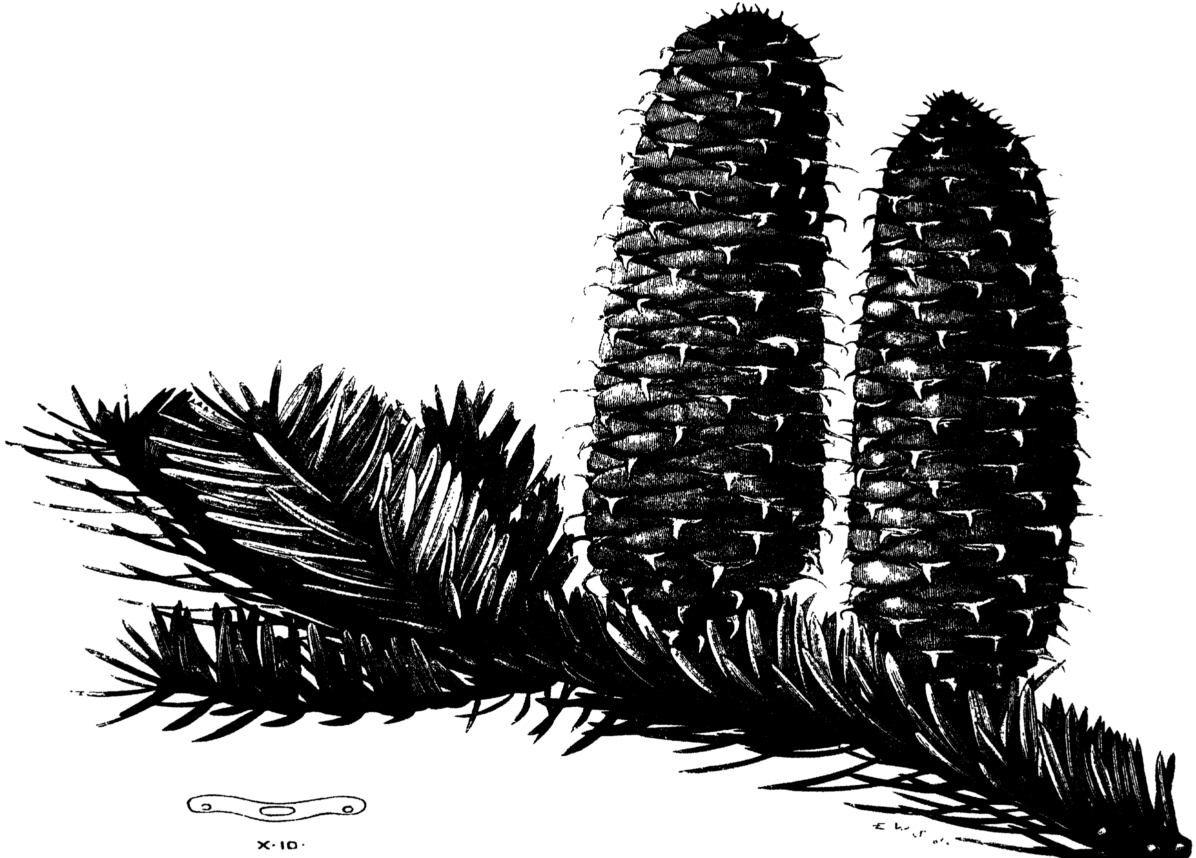


FIG. 31.– ABIES CEPHALONICA, SHOWING FOLIAGE OF FERTILE BRANCH, CONE, REAL SIZE, LEAF SECTION, MAGNIFIED.
The male parent of M. de Vilmorin's hybrid.

(To face page 106.)

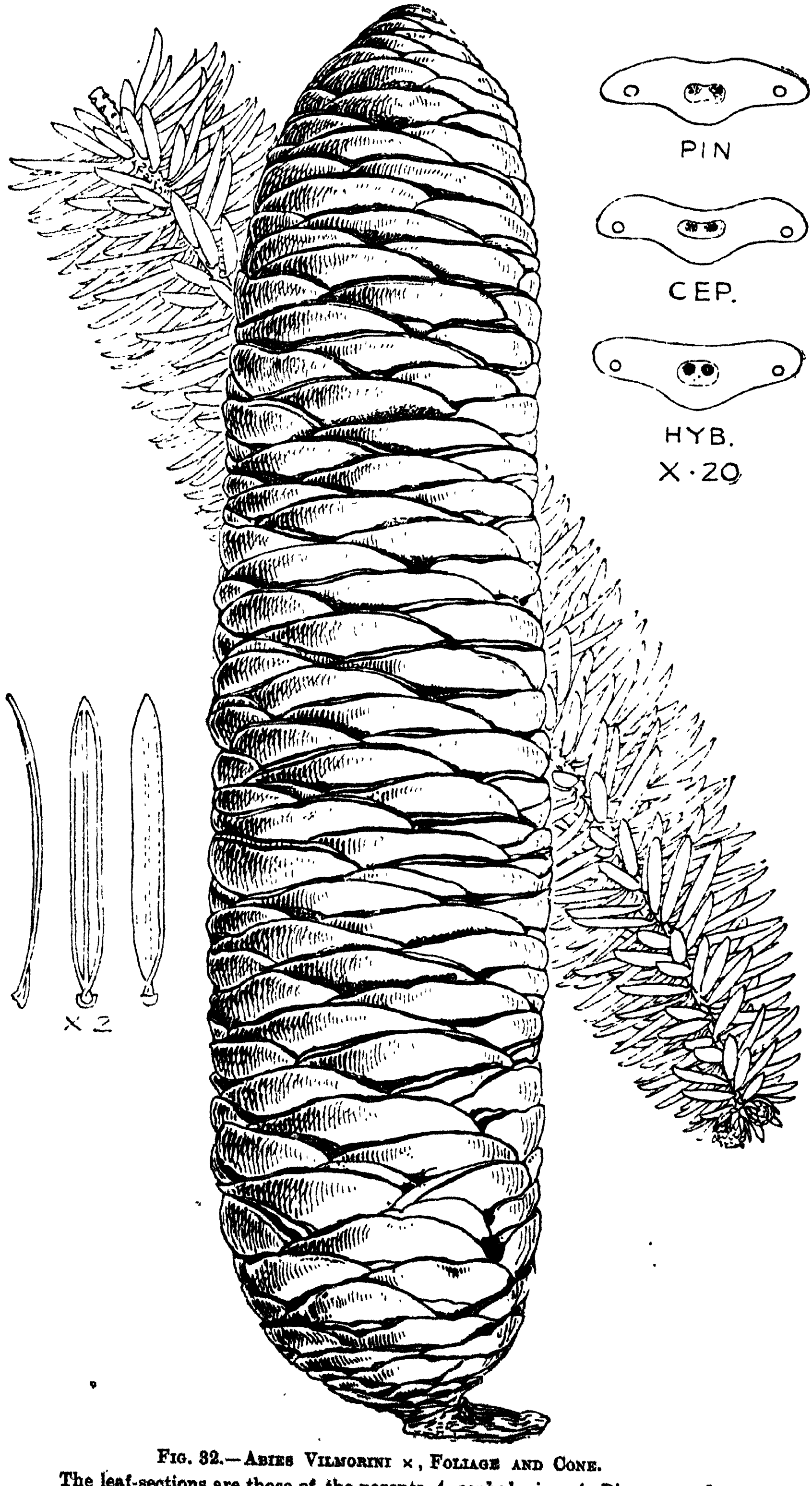


FIG. 32.—ABIES VILMORINI ×, FOLIAGE AND CONE.
The leaf-sections are those of the parents *A. cephalonica*, *A. Pinsapo*, and

to the courtesy of M. Philippe de Vilmorin, I am enabled to lay before the Committee cones and foliage from this hybrid Conifer.

The history of the tree was given by M. Em. Bailly in the "Revue Horticole," March 1889, page 115.* From this we learn that in the spring of the year 1867 M. de Vilmorin placed some pollen of *Abies cephalonica* (fig. 31), a very near ally of *A. Nordmanniana* and of *A. excelsa*, on the female flowers of *A. Pinsapo* (fig. 30). A solitary fertile seed was produced and was sown in the autumn of the same year. Germination ensued, and the seedling was planted out in 1868. The tree is therefore now (1901) thirty-four years old. In 1878 its height was recorded to be three feet,† and M. P. de Vilmorin tells me it now measures fourteen and a half metres (about forty-six feet), and would have attained greater dimensions but that its leader has been destroyed. On the whole, says M. Bailly, the tree more nearly represents the male parent (*cephalonica*) than it does the female (*Pinsapo*). This is evident in the general appearance, the habit, the two-ranked arrangement of the leaves, their length and their silvery tint. The cones (fig. 32) are also more like those of *A. cephalonica* than they are like those of *A. Pinsapo*. They are oblong fusiform, and, according to M. Bailly, the tips of the bracts project beyond the edge of the seed scale, which they do not do in *A. Pinsapo*. The two cones forwarded by M. de Vilmorin in December 1900 do not quite conform to M. Bailly's statement, for it is only in a few cases that the bracts, especially those near the base of the cone, project beyond the scale. This diversity of proportionate length between the bract and the scale is, however, so frequent in Conifers that little or no importance can be attached to it as a diagnostic character.

So far as the number, strength, length, and decurved direction of the branches and the thickness of the leaves are concerned, the hybrid more nearly partakes of the characteristics of the female parent, *A. Pinsapo*. Up to last year, although the cones matured, the seeds remained sterile, but in 1900, according to information kindly furnished by M. P. de Vilmorin, it produced good seeds for the first time, and we await with interest the production of seedling plants. It is not necessary in this place to repeat the detailed description of the tree which M. Bailly has given (*l.c.*), the foregoing summary being sufficient for my present purpose. Still less is it requisite to give a detailed description of the parent plants, such as may be found in any of the authoritative text-books, such as Veitch's "Manual of the Coniferæ," second edition (1900), p. 498 and p. 531. It may, however, be well to allude to those details of leaf-construction which are made use of in distinguishing one species from another.

In both *Abies Pinsapo* and *A. cephalonica* there is, immediately beneath or within the skin or epiderm, a double layer of thick-walled cells constituting the "hypoderm." Next comes the "palisade" tissue, consisting of two or three layers of closely packed oblong cells, and then the ring of cells surrounding the central bundle and known as the "endoderm." The "hemistele," or central half-cylinder, consists of the "pericycle," a mass of cells surrounding the fibro-vascular bundle.

* See also Beissner, *Handbuch der Nadelholzkunde* (1891), p. 443; *Gardeners' Chronicle* (1878), p. 438.
† *Gard. Chron.* (1878), p. 438.

This bundle branches into two divisions connected by an arched band of tissue. In *Abies Pinsapo* the resin canals are either placed in the substance of the leaf removed from the epiderm by two or three layers of cells, when they are said to be "parenchymatous," or they are placed immediately beneath the epiderm (sub-epidermal). I have found the resin-canals in this species occupying both positions in leaves taken from the same branch.

In *A. cephalonica*, as in *A. Nordmanniana*, the canals are sub-epidermal, that is, they lie immediately within the hypoderm or only separated from it by a single layer of cells.

In the hybrid, as in *A. Pinsapo*, I find the position of the resin-canals variable. Most often they are parenchymatous, sometimes sub-epidermal (fig. 33), whilst in one leaf that I examined the canal was parenchymatous on one side of the leaf and sub-epidermal on the other.

From what has been said, it is clear that while some alleged hybrids are only conjecturally of hybrid origin, there is definite proof that several

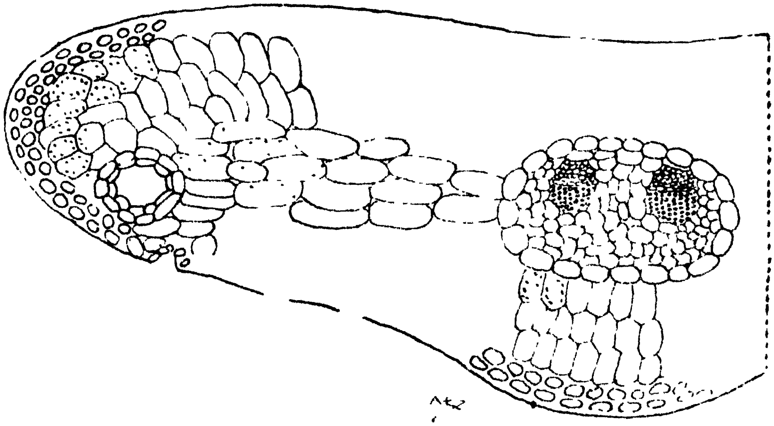


FIG. 33.—ABIES VILMORINI ×, LEAF SECTION, HIGHLY MAGNIFIED.

of them are really of mixed parentage. Others are probably stages of growth, such as are so remarkably exemplified in many Conifers, such as *Juniperus*, *Cupressus*, &c. Before their real nature was brought to light a separate genus for their reception was made under the name Retinospora, a name which, though still used in gardens, has now no botanical significance.

To M. Henry de Vilmorin belongs the credit of having been the first to raise with his own hands, in 1867, a hybrid Conifer. His son, M. Philippe de Vilmorin, purposes to study the tree critically from the anatomical standpoint, and we may confidently hope that this may not only be a filial duty and a continuance of the famous family tradition, but also a substantial acquisition to botanical science.

Of the possible practical benefit of hybridising Conifers it is, of course, too early to speak with confidence. It may, however, be hoped that the new forms which may in the future be originated may prove of advantage

in securing varieties better adapted than existing ones to different conditions of soil and climate.

M. Moser's specimens, raised in 1878, are vigorous and handsome and are from 4 to 6 metres in height. The hybrid Picea "No. 5" (fig. 29) is described as about 4 metres in height, very handsome, well furnished, and of better habit than *P. ajanensis.*

OBSERVATIONS ON SOME OF THE PLANTS EXHIBITED.

By Rev. Prof. G. HENSLOW, M.A., &c.

[JANUARY 29, 1901.]

GREENHOUSE RHODODENDRONS.—The selection of blossoms exhibited by Mr. Veitch included numerous hybrids, of which the following were selected for remarks. The two original species from which the whole series sprang were *R. jasminiflorum* (white), having a long tube and narrow border, somewhat resembling the flower of the jessamine, hence its name, and a larger flowered species, *R. javanicum*. This is orange with a short tube and broad rim.

The first result obtained was a rose-coloured "Princess Royal" and a sister-hybrid, the dark crimson "carminatum." On re-crossing the former with *R. jas.* the offspring was the large-flowered pure white "Princess Alexandra." Thus, by crossing "orange" with "white," first the yellow was exterminated and finally the red.

Other species were now introduced, crimson and yellow flowered. By the aid of these some hundreds of hybrids and subsequent crosses were obtained, many of which were shown. Thus the "Cloth of Gold" has the following genealogy :—

R. jasminiflorum (white) × R. javanicum (orange).
|
Princess Royal (pink) × R. Brookeanum (pale yellow).
|
Duchess of Teck (crimson) × R. javanicum (orange).
|
Lord Wolseley (red orange) × R. Teysmanni (golden yellow).
|
Cloth of Gold (pure yellow).

This is therefore a hybrid of the fourth generation, containing four true species and one (*R. jav.*) twice. This example will give some idea of the perseverance and skill of Mr. Heal, the raiser of them on Messrs. Veitch's establishment.

Another feature was shown in the prepotency of some species; thus, when a large-flowered hybrid was crossed with the very small-flowered *R. malayanum*, the offspring partook of the form and colour of the latter, being only a little larger.

This now well-known feature among the results of hybridisation, viz., that the offspring entirely resembles one or other parent, has been called by the French "false hybridisation." It means that while the parents can give rise to perfect offspring, yet one is so prepotent that the hybrid progeny exhibits no perceptible sign whatever of the other.

A new hybrid was also shown between the species *R. Javanicum* and *R. Teysmanni*, having very fine trusses of golden-yellow flowers, showing how the "red" out of the orange colour of the second parent was completely suppressed. It was appropriately named "King Edward VII."

THE WINTER ACONITE.—This plant and some Hellebores exhibited by Messrs. Barr and Sons afforded an opportunity of explaining how some petals have arisen out of anthers. Both of these genera have a yellow, white, green or purple coloured calyx, but no corolla. In lieu of the latter there are numerous little nectaries. These consist of short tubes supported on little pedicels. Transitional examples clearly show that they are constructed out of abortive anthers, which are open at the top, the partition arrested, the pollen suppressed, and instead of it the inner surface secretes honey.

In some species of *Ranunculus*, such as the Goldilocks (*R. auricomus*), transitional structures of a similar nature may be found, but passing over into petals, by one, the outer side of the nectary, becoming larger. Now, if a true petal of a Buttercup be compared it will be seen at once that this side has expanded into the orbicular petal, while the nectary is now represented as a small pit at the base of the inner surface, the inner side of the anther still remaining as a tiny flap in front of it.

In Water Lilies the transition between stamens and petals is a normal occurrence, but in this case the filament broadens into a petal, while the anthers disappear from the edges. If they be looked at in a comparative way with leaves, then we might say it is the blade which becomes the petal in Aconite, but the petiole in the Water Lily. A similar contrast is seen in the formation of bracts. In the Hellebore a perfect transition between a leaf with its divided blade and the small, oval pointed bract can be readily traced, when it will be seen that the bract is entirely "homologous" with the petiole, the blade being altogether suppressed; whereas in Buttercups, the bracts on the flowering stems consist of the much degraded segments of a blade, reduced in number to three, two, or one, while the petiole is suppressed.

HYBRID HELLEBORES.—Mr. Barr exhibited an interesting series of hybrids, or rather crosses according to Mr. Baker's view, who considers *H. orientalis* to be a true species. This is a native of Macedonia, Thrace, Asia Minor, and the neighbourhood of Constantinople. It has at least nine varieties, three with white sepals, including the type, two with white sepals tinged with green, two with decidedly green sepals, and three with sepals of a deep purple colour.* The crosses in question lie between the vars. *guttatus* and *antiquorum*, which are white, with *colchicus* and *abchasicus*, which have purple flowers; but as several of the progeny have greenish-purple flowers this result is probably due to the admixture with the true species, *H. viridis*, or with the var. *caucasicus* of *H. orientalis*, which has green sepals. This *orientalis* group has the advantage of possessing evergreen foliage; as the old leaves remain on the plants until the new ones supersede them. It may be added that Mr. Baker recognises seven varieties of *H. viridis*, a native of England, as also is *H. fœtidus*. Mr. Baker writes, "*H. viridis* is, I believe, truly wild in the woods of the limestone hills of the North of England, growing with such plants as *Actæa spicata* and *Aquilegia vulgaris*;" but both the above species were wild in the village of Hitcham, Suffolk, and collected by the late Prof. J. S. Henslow, whose specimens

* See *Gard. Chron.* 1877, p. 466.

were exhibited. Sir J. D. Hooker gives "S. and E. England" for both species.

GALANTHUS ELWESII var. *Whittali.*—Mr. Barr exhibited a fine variety of this well-known species, originally brought by Mr. Elwes. It differed in the more expanded petal than in the true type, these are somewhat rolled inwards. It was discovered near Smyrna by Mr. W. Whittal, and is apparently a local variety.

COLEUS.—The blue flowered species with tall spikes, exhibited by Mr. Veitch, is remarkable for the great length of time it continues to flower, the same individuals exhibited having been shown for the third time, and there were still many flowers to come out. It thus proves itself to be an invaluable plant for conservatories at this season of the year.

The structure of the flowers is remarkable, for instead of having the stamens and style erect under the hood, as in the Deadnettle of the same family, *Labiatæ*, they lie down along the extended lower lip. A similar contrast may be seen in the two genera of the order *Scrophularineæ*, the Snap-dragon, in which those organs are erect, and *Collinsia*, where they are horizontal or declinate.

Thus there is a kind of mimicry between these pairs of flowers; and the interpretation suggested is, that similar insects have habitually visited the flowers, which have responded to the irritations set up and so constructed flowers somewhat alike, within the limits of the possibilities of their previous structures respectively. It may be added that *Coleus* and *Collinsia* both mimic the flower of the pea.

PRIMULA SINENSIS.—With regard to this flower it is interesting to see how "taste" reverts; for when this plant was first introduced into England, about the year 1820, the form familiar to growers had a tall stem producing whorl after whorl of flowers, separated by long internodes. The corollas were about the size of a wild Primrose, or scarcely so large, of a rose-pink colour, and deeply notched. In the Primulas of late decades of the last century the flowering stem is short, with an umbel of flowers, the corollas being large, the petals overlapping and leaving no gaps, while the colours are various and deep, not to mention the double-flowered forms.

The original form, or something very like it, is now largely grown as "The Lady" by Mr. Cannell, and as "Stellata" by Messrs. Sutton, but it is practically a variety of the originally introduced one, probably long cultivated in China; because it is very different in size, especially, from the true wild species occurring in the mountains of China.

Mr. Henslow exhibited an original drawing of *P. sinensis* made in 1820, and a specimen dried in 1827 from a private garden, for comparison.

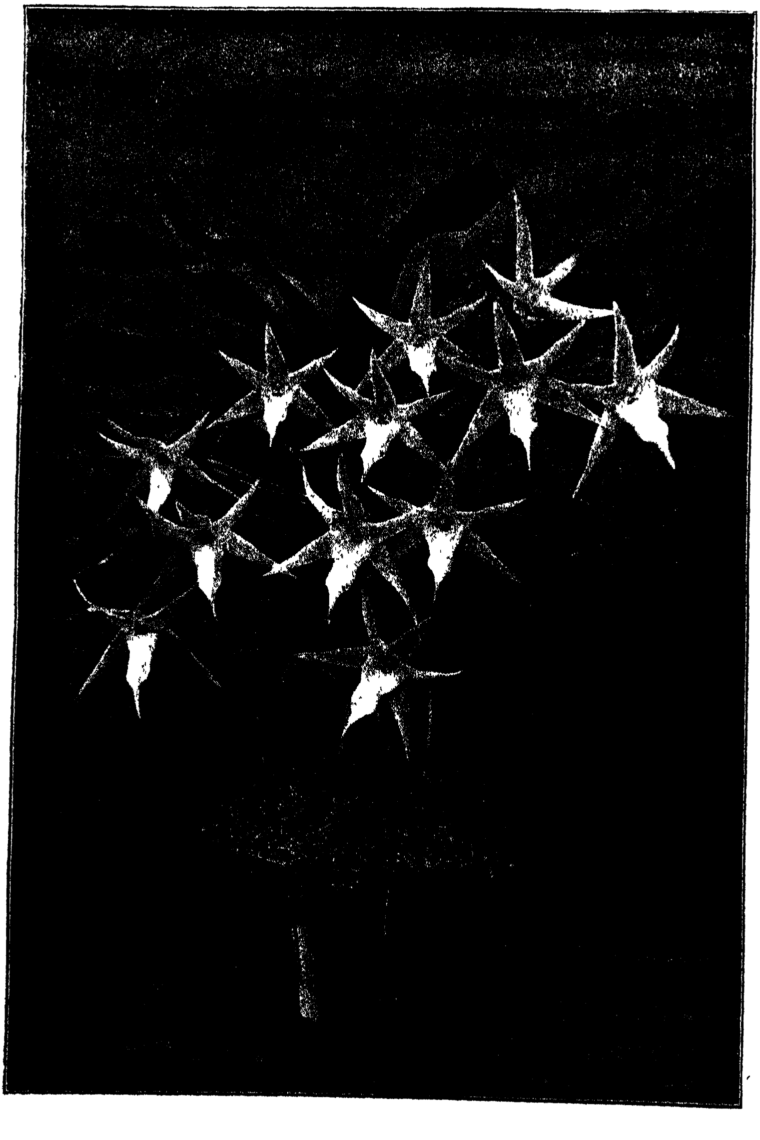
The structure of the flower of all Primroses reveals an anomalous feature. According to the universal law of alternation every whorl should have its parts alternating in position with those of the whorls next to it, so that each petal should stand in front of the interval between two sepals, &c.

In the Primrose family the five stamens stand in front of the petals, thus breaking through the rule. If, however, one examines the flower of

Brookweed (*Samolus Valerandi*), common in marshy places, and a member of the Primrose family, five little stumps will be seen alternating with the five petals, so that they represent a lost whorl of stamens. The parts of the flower, therefore, may be thus expressed:

S.		S.		S.		S.		S.		(sepals)
	P.		P.		P.		P.		P.	(petals)
*		*				*		*		(lost stamens)
	St.		St.		St.		St.		St.	(stamens)
C.		C.		C.		C.		C.		(carpels)

Thus the law of alternation finds itself restored.



THE MAKING AND UNMAKING OF FLOWERS.

Lecture delivered February 26, 1901,

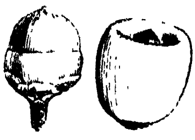
By Rev. Professor G. HENSLOW, M.A., F.L.S., V.M.H., &c.

PART I.--THE MAKING.

IF we ask—What were the first flowers like? it is not easy to reply; for plants are so much more perishable than shells and bones that the destruction of primitive forms of vegetation has been very much greater than that of animals. Still we know that some of the earliest land-plants were Cryptogams. Such were the allies of our existing Ferns, Club-mosses, and Horsetails; for these constituted the larger portion of the forests which contributed their remains to form our coal beds.

Now modern researches have discovered points of affinity between certain Gymnosperms (represented in these islands by the Scotch Fir, common Juniper, and Yew only) and the above-mentioned Cryptogams; so that the bridge from flowerless to flowering plants undoubtedly existed between these two groups of plants; but we do not know where to look for the *site* of the actual bridge itself.

Our starting point is, therefore, *Gymnosperms*,* *i.e.* "naked-seeded plants," forming a sub-class of Dicotyledons; and the first question is—



a b

FIG. 34. *a*, Ovule, half grown, with developing cup, bracts seen below; *b*, ripe seed included within the scarlet cup.

a b

FIG. 35.--*a*, Stamen; *b*, carpellary scale of Scotch Fir, with two pendulous ovules.

How did these naked-seeded trees and shrubs pass into others with a pistil in which the seed is enclosed, and therefore called *Angiosperms*, *i.e.* "seeds in a vessel"?

Let us take the simplest case possible, the female flower of the Yew (fig. 34). It consists of an ovule only. This constitutes the whole flower. It is at first protected by a number of minute, overlapping and roundish little bracts; but there is no trace of a carpel of any sort. A succulent cup grows up and nearly conceals the naked seed when ripe.

In the Juniper, the Fir tree (fig. 35), and the Cypress (fig. 36), we find an open scale associated with one, two, or several ovules respectively. It is sometimes called a "carpellary" scale, but whether justly so or not is open to question. In *Cycas* (fig. 37) there occur small leaves with ovules on their margins.

* This embraces three families only—*Gnetaceæ*, with 3 genera; *Cycadaceæ*, with 9; and *Coniferæ*, with 32.

Here, therefore, we seem to see some approximation to a carpel, such as a pea-pod when split open down the coherent margins. The pod then resembles this carpellary leaf-scale of a Cycad with its two rows of ovules.

There is yet a third family of Conifers, comprising three genera only, which supplies us with something like a perianth, and the appearance, at least, of an ordinary flower.

Gnetaceæ, like the *Coniferæ*, have the sexes separate, and each is pro-

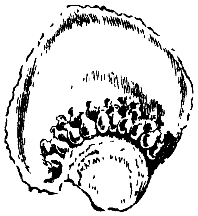


FIG. 36.—Carpellary scale of Cypress, with many erect ovules.

FIG. 37.—Carpellary leaf of *Cycas*, with six ovules on the margins.

tected by a perianth, consisting of four separate leaves or bract-like structures in *Welwitschia*, and a gamophyllous one in *Gnetum* and *Ephedra*; but there is no trace of a pistil.

Besides the female flower of *Welwitschia* there is a male flower, but hermaphrodite in form, as it contains a central ovule, but it is abortive (fig. 38). It consists of a perianth composed of two pairs of scale-like leaves, several stamens in a coherent whorl, and an ovule in the centre. This latter, however, though it has a styliform process above, is closed at

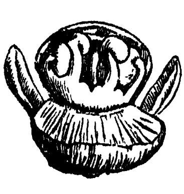
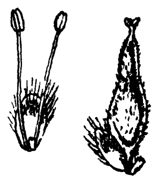


FIG. 38.—Male flower of *Welwitschia*.



a b

FIG. 39.—*a*, Male flower; *b*, female flower of Sallow Willow.

the apex; so that the flower is really male only. As *Welwitschia* has never more than one pair of leaves besides the cotyledons, we can trace the source of the two pairs of decussate leaves of the perianth from the original opposite conditions of its primordial leaves. The scales of the cones of this plant are similarly arranged.

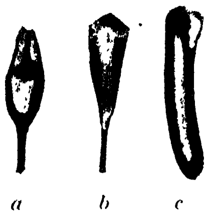
The next step is to see if we can find plants among angiospermous Dicotyledons which point to any affinity with Gymnosperms. Herein lies

a difficulty, because no strictly intermediate step is known. There is a genus, a single type of a family called the Beefwoods of Australia (*Casuarina*), which is a solitary genus, a relic of a bygone ancestry, which has one or two points of resemblance, but one can hardly regard them as indicating affinity. Thus, just as *Gnetum* has a single stamen within a coherent perianth, so, too, has *Casuarina*. As the fruit of *Welwitschia* is invested by a close-fitting perianth, so is it in *Casuarina*. But while the latter has a perfect pistil, no member of the Gymnosperms has any at all.

Our Sweet-Gale (*Myrica*) has certain affinities with, or at least resemblances to, *Casuarina*.

There are some other members of the "Incomplete" division of Dicotyledons, which we may feel inclined to regard as primitive types, on account of the extreme simplicity of their flowers, and also because they are isolated genera. Thus Willows (*Salix*) and Poplars (*Populus*) constitute an entire Order. In the former (fig. 39) there are two or more stamens in the axil of a bract for a male flower; while the female has only a pistil composed of two carpels. Moreover, Poplars are among the earliest of flowering plants known to geologists.

All these and many others afford no true connections with Gymno-



a *b* *c*

FIG. 40.—*a*, Nectary of Winter Aconite; *b*, of Christmas Rose; *c*, of Fetid Hellebore.

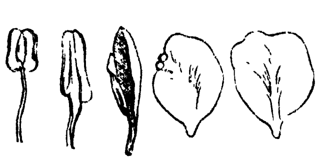


FIG. 41.—Transitions from stamens to petals in a double Rose.

sperms, as they are provided with perfect pistils, having styles and stigmas. Hence the links are still wanting to connect these groups.

We must now suppose that Nature has succeeded in making a calyx, at least, within which are either stamens or a pistil, or both together. As every part of a flower is homologous with a leaf, and as leaves are not joined together in any way, we must look for a flower having all its parts separate. Thus a Buttercup, and other members of the same family, will answer this condition. Conjointly with this, I will take the Winter Aconite and two kinds of Hellebore, for in the last two Nature has not yet made a corolla. In the middle of these flowers are several free carpels; then, numerous stamens; around them are little honey-secreting vessels, where we should expect a corolla; and lastly, is a green calyx in Hellebore, and a yellow one in the Winter Aconite.

Now, what is the origin of these little honey-pots? A close examination will reveal that they are made out of anthers. They are open at the top, no pollen is formed, but instead, the inner surface secretes honey. In the Winter Aconite especially the outer side is a little longer than the inner (fig. 40, *a*). If now we compare it with the petals of various species of Buttercup, we soon find transitions in size between these "nectaries," as

they are called, and the complete petal of a field Buttercup. Hence we discover that one way of making a petal is to construct it out of an anther. The filament plays no part, merely remaining as a little stalk to support the nectary.

If now we compare this with a Water Lily, we shall find that it is the filament and not the anther which makes the petal. There is a perfect transition between stamens surrounding the pistil, each having a narrow filament and long anthers; but as one passes from the centre to the circumference of the flower, we find the filaments broadening and the two cells of the anther disappearing, first from one side then from the other, so that at last a perfect petal is obtained. A similar transition may be seen in imperfectly double Roses (fig. 41).

The next process, which is already partly effected in Buttercups, is to reduce the number of parts, if numerous, and make whorls instead of spiral arrangements.

In a Buttercup the sepals make a whorl, and the petals another whorl of five parts in each; but the stamens and carpels are very numerous and arranged in spirals. The interpretation of the number 5 is very simple. If a shoot of a Rose, May or Oak be examined, let any leaf be called No. 1. Then, if a line be traced from leaf to leaf, it will be found to

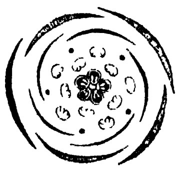


FIG. 42.—Diagram of flower of Geranium.

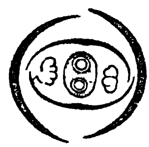


FIG. 43.—Diagram of flower of Enchanter's Nightshade.

describe a spiral round the shoot, until a leaf (the 6th) is in the same vertical line as No. 1. These *five* leaves constitute a "cycle;" the 6th begins the next cycle; and so on. If these five leaves could be brought to the same level by an arrest of the internodes between them we should have a whorl. Such is the origin of the calyx and corolla; but with one exception; the two whorls would be exactly over one another, each sepal being covered by a petal; but to avoid this, Nature shifts the corolla, so to say, that the petals may fall in *between* and not *over* the sepals.

In making flowers, the typical arrangement comes to be as follows: 5 sepals, 5 petals, 5 stamens, 5 more stamens and 5 carpels, each whorl alternating with the next. Such is seen in the flower of Geranium, as shown in the diagram (fig. 42). The dots represent five honey-glands.

From this complete stage reductions often occur, as by suppressing one whorl of stamens and some of the carpels, often leaving only two. As an example, we may take *Geranium*, which has the above quinary arrangement, but the allied genus *Erodium*, or Stork's-bill, has only one whorl of stamens. In St. John's Worts the pistil is reduced to three carpels only, and in Pinks to two.

Sometimes flowers are binary, the parts being in twos, as of the Enchanter's Nightshade (fig. 43); or they may be quaternary, the whorls being partly in fours, as are the sepals and petals of the Lilac and Privet.

It will be noticed that these shrubs have *opposite* and not *alternate* leaves, as on the Oak, so that they are not arranged spirally. Hence they have, presumably, given rise to flowers having their whorls made up of pairs of parts. Thus the Lilac is composed as follows: Calyx, 4; corolla, 4; stamens, 2; carpels, 2. Monocotyledonous plants, as a rule, have the floral whorls in threes (fig. 44). This appears to be due to the fact that the leaves on the stems are so arranged that the *fourth* leaf, when traced up on a spiral line, falls over the one chosen as No. 1, so that *three* leaves make a cycle, and therefore a whorl.

Before we proceed any further it will be as well to ask: What has brought about the changes referred to thus far? It is a fundamental law of evolution that nothing is made *originally* in anticipation of a future use. There must be an external inciting cause, to which the flower responds and builds up the adaptive structures, and *then* it may become hereditary and be reproduced in every subsequent generation *in anticipation* of its use.

The stimulating cause in the case of flowers adapted in their structure for insect fertilisation is the actual visit of the insect itself, when searching

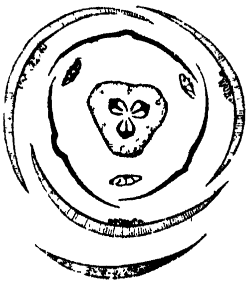


FIG. 44.—Diagram of flower of Iris.

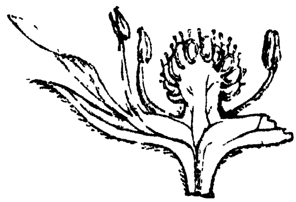


FIG. 45.—Vertical section of flower of Strawberry.

for pollen first, and for honey afterwards, *i.e.* in the evolutionary history of flowers.

If we go back to Gymnosperms again, in all existing species the sexes are distinct, either on the same tree (Fir) or on different trees (Yew).

In the absence of pollen-eating insects, the only way the ovules could be fertilised and ripen into seed is by the wind blowing the pollen on to the exposed ovules.

Now, when insects visit honeyless flowers for the sake of pollen it has been observed that they constantly probe the juicy floral receptacle in order to moisten the pollen. H. Müller noticed bees so doing, for example, in the flowers of the Wood Anemone, &c.

Here, then, we have the first source of "floral irritation." We know of no other, but when we come to speak of irregular flowers we shall see what a number of coincidences there are in the various structures of such flowers, all of which conspire to secure one and the same end; so that the conclusion is irresistible that it is the insect itself which has incited the plant to build up a flower in perfect response both to the insect's and its own requirements.

The first result of such adaptation is that the sepals (as in the Pink), the petals (of the Foxglove), or both of these (in the Primrose), become *coherent* into tubes. Their *use* is, first, to furnish a strong support for an insect alighting on the expanded "limb" of the corolla, as of a Primrose, or more or less crawling inside, as of a Foxglove.

Secondly, it extracts the honey secreted by glands at the base; as is well known to any one who has sucked the tube of a corolla extracted from the flower of the Deadnettle.

This tube may be imitated, but without any cohesion having taken place, as in the Wallflower; in which the four sepals overlap one another in pairs, and, being rigid, they are strong enough to support the slender "claws" or stalks of the petals, as well as the weight of the insect alighting upon their expanded limb.

In a Pink the sepals are coherent, but the petals are of the same form as those of the Wallflower, in having slender claws and an expanded limb; but in a Primrose the claws of the petals have united, and so form a slender tube within that of the calyx. If the corolla-tube is sufficiently strong to carry the insect, it does not require the extra support of a calyx-tube, so the sepals remain free, as in the Foxglove.

The next effect of floral irritation is the production of honey-glands and other growths of the floral receptacle itself.

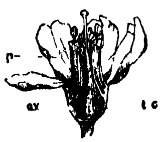


FIG. 46.—Vertical section of flower of Apricot; *p*, petal; *ov*, ovary of pistil, in centre of, *tc*, the receptacular tube.

FIG. 47.—Vertical section of flower of Rose; *re*, receptacular tube; *ov*, ovaries of free carpels within the tube; *sty*, styles of carpels.

The extremity of the flower-stalk is usually somewhat enlarged in order to carry all the parts of the flower; it can be much more enlarged under such a stimulating process as cultivation, as we see in the fruit of a Strawberry (fig. 45); the succulent edible portion being simply an enormously increased apex of the floral receptacle, which carries the seed like carpels, or achenes, only.

Besides this, the receptacle can extend horizontally (fig. 45), and so form a platform or ledge round the base of the flower. The object is to secrete honey. This is particularly well seen in the Raspberry; and is very attractive to bees, which suck up the honey from the circular trough with great avidity. This, together with the honey, is regarded as being the result of the actual visits of the insects themselves.

The effect resulting from this lateral expansion of the receptacle is to push out the calyx, corolla, and stamens to a little distance from the centre, where the pistil remains, as shown in the Strawberry (fig. 45).

This condition of the petals and stamens was called "perigynous," which means *around* the pistil. In a Buttercup, where there is no such lateral expansion of the receptacle (inasmuch as the petals supply the honey), the petals and stamens arise from the receptacle immediately

below the pistil. They are then said to be "hypogynous," *i.e. under* the pistil.

The next step is to see how this lateral expansion can grow upwards and form a cup, in which the pistil is left behind at the bottom, while the sepals, petals, and stamens are carried up to the rim of the cup. This is the case with the Plum, Apricot (fig. 46), and other species of the genus *Prunus*. In the Rose (fig. 47) it forms the "hip;" but this contains several free carpels instead of one only, as in the Cherry.

Yet a further result has occurred. In the genera *Prunus* and *Rosa* the carpels are perfectly free in the interior of the *receptacular tube*, as it is called. But in the Apple (fig. 48) and Pear, Medlar, Quince, and Currant, the carpels have become welded with the thickened tube, so that the *inner* epidermis of the latter, and the *outer* one of the former, are arrested, and the middle layers of both become amalgamated into one mass, which constitutes the edible part of the Apple, &c. It is the inner epidermis of the carpels which constitutes the core.*

In the illustration of the Apple, the remains of the sepals and stamens (the petals having fallen off) on the top or "eye" indicate the fact of the calyx being, as it is called, "superior"† and the fruit "inferior." Similarly, in the figure of the flower of Currant (fig. 49) it will be seen how the large calyx is spread out like a dish above the ovary, the smaller

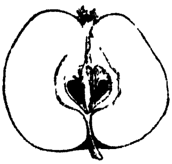


FIG. 48. Vertical section of Apple.

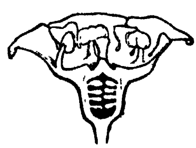


FIG. 49. - Vertical section of flower of Currant.

petals alternating with them; then the stamens follow in front of the sepals. The lining of this dish is the honey-secreting surface of the expansion of the receptacular tube, which is adherent to the ovary below.

The next features to be noticed are described as "regularity" and "irregularity" of flowers. The first is applicable to each whorl, and means that all its parts are exactly alike. Thus a Buttercup, a Columbine, a Rose and a Primrose have every whorl regular. But if the parts of a whorl are not all alike in shape, &c., then such a whorl is irregular; and as it gives a peculiar appearance to the whole flower, the flower itself is usually said to be irregular (figs. 50, 51).

It is here where the influence of the irritations set up by insects become most apparent.

The first coincidence observable is that regular flowers are almost always terminal; and if lateral they stand away from the main stem sufficiently to allow of their being visited from all points, and so they remain regular. Thus in a Geranium there are five honey-glands situated symmetrically round the base of the flower on the receptacle (fig. 42).

* The double line in fig. 48 indicates the line of junction between the receptacular tube and carpels.

† These terms are only applicable to the *calyx* and *ovary*. In a Buttercup the ovary is "superior" and the calyx "inferior," as there is no receptacular tube adherent to the ovary.

Similarly in a Columbine every one of the five petals has a spur which secretes and holds the honey, and this flower can be approached from all sides; but when we compare it with the Deadnettle (fig. 50), Salvia (fig. 51), or Aconite we find that the bees only visit these flowers from one side, *i.e.* in front, as they all have very short pedicels, and are arranged

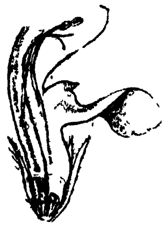


FIG. 50.—Vertical section of flower of Deadnettle.

FIG. 51.—Flower of Salvia, visited by a humble-bee.

close to the main axis or stem. *This is the rule for all irregular flowers.* Hence we see an obvious coincidence between "irregularity" and a special method of visiting flowers.

But it is when we come to study such flowers in detail that we discover innumerable structures which, *taken together*, supply an irresistible amount of inductive evidence in support of the theoretical contention that they have all been evolved simultaneously in response to the direct and mechanical actions of the insects visiting the flowers.

Let us take the family called "Labiates" and the Deadnettle (fig. 50)

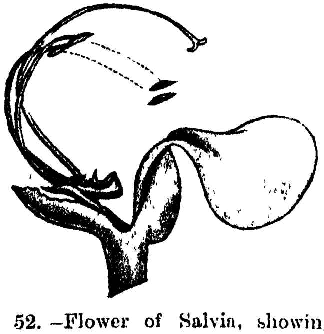


FIG. 52.—Flower of Salvia, showing action of anthers.

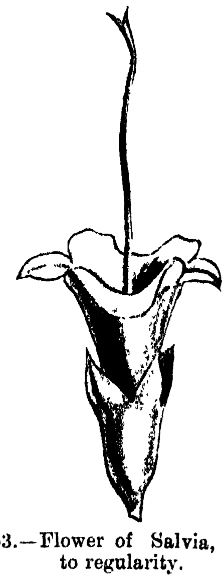


FIG. 53.—Flower of Salvia, reverting to regularity.

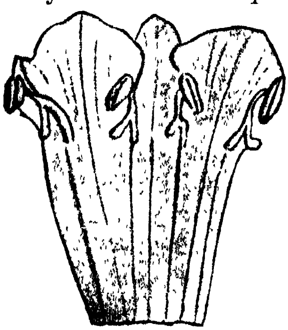
as a type. The first thing the insect requires when coming to it from the front is something to alight upon. The front petal has therefore grown out much larger than all the rest and forms the "lip." Now the weight of the bee has to be supported, the basal parts of the petals cohere into a tube accordingly; and as the tube is very slender compared with the

limb, the calyx follows suit and becomes a tube as well, and supports that of the corolla.

Now, the bee alighting on the front petal, it is clear that its weight is not equally borne by all parts of the tubes, "the strain will be felt" as bearing heavily upon the anterior side, tending, as it were, to split the tube across laterally. Let us see what nature has done to meet this contingency. The calyx not infrequently has actually become two-lobed in consequence, as in Salvias (fig. 51) and in the Furze, of another family (*Leguminosæ*); and in order to strengthen the calyx strong ribs of woody tissue are run up just where the strain is most felt, and where there is a tendency to split the tube. Thus at the sides two new cords are added, as well as in front; and in some species, where the pull or drag would seem to be especially great, an extra cord is inserted, as in the accompanying diagram of the cords in the calyx of a species of Salvia. The calyx being composed of five coherent sepals, each being a representative of a leaf, will have a mid-rib. Let d stand for these primitive *dorsal* cords, as they are prominent at the back of the leaves, then five d's would be the normal and complete number. But we find *marginal* cords inserted as well (m), only one on each of the posterior lines of union where the strain is least, but two at the anterior and lateral lines of union, s being a supernumerary cord in front.

```
      d
   m     m
 d         d
m           m
m           m
 d         d
   m     m
      s
```

In other members of the Labiate family slightly different numbers of cords are inserted; but always such as are required in each case to meet



IG. 54.—Corolla of regular Salvia laid open, showing four perfect stamens.

the necessary strain caused by the habitual visitors of the flowers in question.

Next let us come to the stamens. The normal number is four, one having been suppressed of the ancestral five. This number was undoubtedly the original one, for the flower was once perfectly regular. This is proved, not only by inductive evidence, but by actual cases where Labiates "revert" to the original form, and bear regular flowers with four or even five complete stamens (figs. 53, 54). Of these four, two arise from the posterior and two from the anterior side of the corolla tube, but all four lie along the back of the flower, as in the Deadnettle (fig. 50). The anterior pair have become, presumably, pushed across by the head of the

insect till they remained there, so that now the four anthers stand together under the "hood" of the corolla. The style is bent backwards in the same way; and then, arching forwards, the stigma is brought to the front; and the whole flower is thus in perfect adaptation to the bee, which thrusts its thorax against the anthers of the stamens above it, while the stigma strikes it on the same spot. Such is the method of pollination in the Deadnettle.

In Salvias the stamens have become even more curiously adapted, two only being effectual. They have very short filaments, and the anthers swing up and down upon them, as on pivots. The anthers are extraordinarily modified. By reference to fig. 52 it will be seen that the connective which joins the two anther cells is elongated into a curved rod, carrying one anther containing pollen at the top, while the other, which is open and devoid of pollen, is at the bottom. They constitute two levers, so that when a bee's head depresses the spoon-like lower extremity, the upper anther cells swing down into the position shown in fig. 52, and strike the bee on the back, as shown in fig. 51. On entering another

a *b*

Fig. 55.—*a*, Flower of *Duvernoia adhatodoides*; *b*, same visited by humble-bee.

flower, the stigma hits the bee where the pollen had been previously deposited.

Now, where are the honey-glands in these irregular flowers? We have seen that in regular flowers, as the Geranium and Raspberry, the supply is obtained from five glands situated at regular intervals on the floral receptacle in the former, and in a circular trough in the latter, because the insects can visit the flowers from any quarter. It is otherwise with irregular flowers. The honey is accordingly supplied from one gland only, and this is situated precisely where the proboscis of the insect can get it. Sometimes it is on the front or anterior side, as in Deadnettles, &c.; sometimes on the back or posterior side; but in each case it is exactly in keeping with all the other details of the flower.

Besides the above peculiarities special markings are upon the petals, called "guides," or "pathfinders," to call the insect's attention to the right direction where to thrust its proboscis. If the gland is on the anterior side, then the markings are on the lip petal immediately over it, as in the Violet and Pansy, Labiates, &c. But if it be on the opposite side, then the guides will be found on the posterior petal or petals, as in Pelargonium, Rhododendron, &c.

We thus see what an accumulation of features there are, all conspiring to one and the same end—namely, the adaptation of the insect to obtain

honey, and while doing so the pollination is secured by means of the insect itself, which thus unwittingly aids the plant.

Such is the line of inductive evidence, leading to the conclusion that all the adaptations to insect agency have resulted from the power of the living protoplasm within the plant to respond to the irritations, and to build up structures in correspondence with the requirements both of the insects on the one hand, and of the plant itself on the other.

Before concluding this part, I will give one more illustration, and quote what I have said about it elsewhere.*

The accompanying figures of the flowers of *Durernoia* (fig. 55) show how they are strictly in adaptation to the bee visiting them. Looking at *a* alone (supposing we knew nothing of insect visitors), one might ask, For what use is this great irregularity? Why and how has it come into existence? And no answer is forthcoming. Now, turning to *b*, we see one use at least. The weight of the bee must be very great; and the curious shape of the lip, with its lateral ridges, is evidently not only an excellent landing-place, but is so constructed as to bear that weight. Moreover, the two walls slope off, and are gripped by the legs and pressed by the wings of the bee, so that it evidently can secure an excellent purchase, and can thus rifle the flower of its treasures at its ease.

It is *almost* always the anterior petal which furnishes the landing-place; if, however, the pedicel or inferior ovary has been too weak to support the insect, then it has sometimes become twisted to supply additional strength. The consequence is, that the posterior petal becomes anterior in position, and is now the larger one, since it supplies the landing-place for insects, as in orchids. This fact supplies an additional argument to the theory that such irregular flowers are the result of insect agency.

Part II.—The Unmaking of Flowers.

Evolution is always accompanied by devolution or degradation, not to add stagnation. This is a compensatory process; not that it implies anything derogatory, but it signifies that an organ which had its use under previous conditions is no longer required under another set of circumstances; so that while new structures arise to fit the animal or plant for new conditions of life, so the older ones tend to and often totally disappear, or they remain as rudimentary structures. Hence animals and plants abound with these so-called "rudimentary organs."

In flowers we find that sometimes one part of a whorl, sometimes another part, vanishes; or again, whole whorls may disappear altogether, so that a flower may become reduced to three, two, or one whorl only.

A few illustrations will show this. Let us begin with the calyx. When flowers are much crowded, this organ tends to be, and often is, quite arrested. In Rhododendrons it remains as an almost invisible five-toothed rim at the base of the corolla-tube. In Woodruff (fig. 56), Galiums, and in most members of the Umbelliferous family there is little or no trace of it. In all these the corolla, stamens and pistil are present.

* *Origin of Floral Structures*, p. 106.

Similarly in the great family of Composites, in which the flowers, or florets as they are called, are densely crowded together, the "superior" calyx is either reduced to a circle of hairs, called the "pappus" (fig. 57, *a*), which ultimately becomes elevated by a growth of the receptacular tube and forms the parachute to the fruit of the dandelion, *b*; or else, as in Daisies (fig. 58), there is no calyx at all. In the "ray" or circumferential

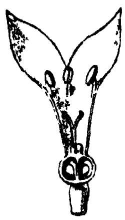


FIG. 56.—Vertical section of flower of Woodruff, showing 2-celled inferior ovary, no calyx, and corolla with adherent stamens.

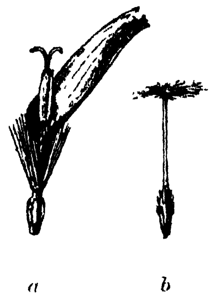


FIG. 57.—*a*, Floret of Dandelion; *b*, fruit.

florets the strap-shaped corolla *b* has only *three* instead of *five* petals, as in the "disk" florets *a*. The five stamens seen in *a* have totally vanished from *b*, only the pistil with its inferior ovary, style and two stigmas being retained.

In some flowers the process is reversed, the calyx remaining while all the rest of the flower is suppressed. This occurs in the outermost flowers of a corymb of Hydrangea. The flowers themselves can set no seed, but the calyx being white or coloured attracts insects to come to the inconspicuous flowers which form the great mass of the cluster.

In the Guelder-rose the outermost flowers of the truss are differently constructed; for now the calyx, stamens and pistil are suppressed, the

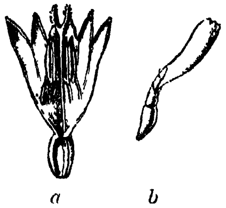


FIG. 58.—*a*, Disk floret of Daisy, with corolla laid open to show adherent stamens with coherent anthers; *b*, ray floret.

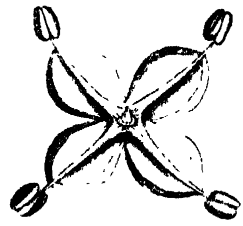


FIG. 59.—Male flower of Stinging Nettle.

corolla alone remaining. This also occurs with the large trumpet-shaped florets on the circumference of a head of the Cornflower. The corolla is enlarged at the expense of all the other organs.

If the calyx be retained, but the corolla suppressed, we get a common condition of members of the *Incompletæ*. When this is the case the suppression of the corolla is indicated by the stamens being situated in front

of the sepals, showing that the intermediate whorl is wanting to sustain the law of alternation of the several parts of the different whorls. Thus, in the male flower of the Stinging Nettle (fig. 59) the four stamens stand immediately in front of the sepals.

Extreme degradation is seen in the Spurges (fig. 60). Within a cup-shaped involucre are many male flowers and one female flower; but these are reduced to the minimum of simplicity, for a male flower consists of a single stamen only; and the female, of a pistil composed of three carpels.

We appear to have an ancestral form in one or more genera of Australia. In *Monotaxis*, for example, there is a central female flower with an involucre of several bracts, surrounded by several male flowers. These consist of a calyx, corolla and stamens. Now if all these were suppressed, excepting a single stamen to stand for the male flower, we should have a structure very similar to that of Spurges.

We must now regard degenerate flowers from the point of view of *function*.

If we compare the blossom of a Wallflower with one of a Shepherd's

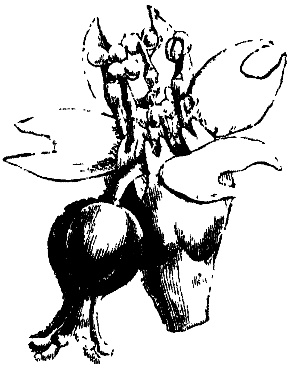


FIG. 60.—Inflorescence of Spurge.

FIG. 61.—Cleistogamous buds of Violet. *a*, bud enveloped in the calyx; *b*, calyx removed, showing the pistil with the five anthers pressed down upon the summit; *c*, a stamen, showing the large oval connective with two small anther-cells near the base; *d*, pistil with a short style and truncated stigma.

Purse, one notices that all the features of the former are in adaptation to fertilisation by insects. Thus the sepals form a rigid tube, the receptacle carries two honey-glands at the base of the two passages, down which a bee's proboscis must pass. The stigmas are spread out so that they form an angle across which the proboscis glides, and so removes any pollen brought from a previous flower. It has a large bright corolla and is strongly scented.

In the Shepherd's Purse, a member of the same family, or Crucifers, the flower is very minute and not at all attractive, and there is no scent. The stigmas are massed into a globe, and the anthers press round upon it, discharging their pollen at once upon the stigmatic papillæ.

The flower has degraded from some condition of ancestral conspicuousness, because it has retained its corolla in a more or less rudimentary form, but has changed from insect- to self-fertilisation.

Violets retreat a step further backwards. After the usual flowers are over, numerous buds appear on the runners under the foliage. These never open, but are perfectly effective for seed-making (fig. 61).

There is an enveloping calyx *a*, no corolla, or only rudiments of

petals; the five stamens have their anthers, *c*, pressed down upon the stigma, and pour out their pollen-tubes while still within the cells as in *b*, penetrating the stigma *d*, concealed beneath them. As the process of pollination and fertilisation is thus concealed, such flower-buds are called *cleistogamous* (*i.e.* "concealed union").

By comparing the details in fig. 61 with those in fig. 62 the degradations of the former will be readily seen. Thus, the calyx in 62 *a* is much larger than in 61 *a*. The corolla has five petals, one being spurred for receiving honey, 62 *b*; 61 has no corolla. Two stamens (62 *c*) have honey-secreting appendages, three having none (62 *d*). In 61 *c* the connectives of all five anthers grow into broad spoon-like processes; no stamens secrete honey. In 62 *e* the style is prolonged into a beak-like stigma, to pick up the pollen from the insect. In 61 *d* the style is very short, having the blunt stigma tucked under the anthers.

In common Plantains (*Plantago* species) we find that degradation has passed from some ancestral insect-visiting forms (since they retain the corolla) to wind-fertilising conditions. The anthers are on long

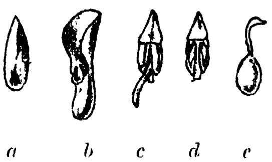


Fig. 62. - Details of flower of Violet. *a*, a sepal; *b*, the anterior petal with a spur; *c*, one of the 2 front stamens, with a honey-secreting tail, which is included within the nectary; *d*, one of the 3 posterior stamens without nectaries; *e*, pistil.

Fig. 63.—Vertical section of flower of Mare's-tail, showing 1 carpel with inferior ovary containing 1 seed, with 1 stamen.

filaments, easily dispersing the pollen, while the stigmas are elongated so as to readily catch it.

Grasses are in the same condition. They probably descended from some form of Monocotyledon which possessed a perianth, for they still have a rudiment in two lodicules, generally; but sometimes three are present, as in bamboos; but grasses are now mostly wind-fertilised.

The question may now be asked—What are the causes of degradation in, or the unmaking of flowers? We may suggest the following as perhaps worthy of consideration.

When a flower passes from an insect-fertilising condition to a self-fertilising one, it is presumably due to the neglect of the insects, and the loss of the stimulus which kept up the flower to its proper standard. In their absence it reverts, more or less, to the *bud-state* of the flower, sometimes expanding, but sometimes not, as we have seen in the Shepherd's Purse in the one case, and cleistogamous flower-buds of the Violet in the other. When it reverts to wind-fertilisation it is reassuming what appears to have been the ancestral condition of flowers, so far, at least, as can be gathered from Gymnosperms.

Another cause of degeneracy in flowers appears to be a residence in water; but this by no means affects all plants, such as Water Lilies; but when flowers of aquatic plants are conspicuous we conclude they are still visited by insects, which counteract any degrading process which the plant most certainly undergoes in its vegetative system in water. If, however, the flowers are inconspicuous and *not* visited, then some cases serve to indicate that degeneracy applies to the flowers as well as to the stems and leaves. Thus the family *Halorageæ* has nine genera: all but three are aquatic plants. The structure of the flowers of the type genus *Haloragis* (mostly Australian) is closely like that of a Fuchsia or Willow herb, as follows: Ca., 4; Cor., 4; St., 4 + 4; Carp., 4; the genus *Gunnera* has the sexes separated as follows: 0; 0; 2; 0 (male); 0; 0; 0; 2 (female). We have three British genera constructed as follows: Mare's-tail (*Hippuris*) 0; 0; 1; 1 (fig. 80). Water Milfoil (*Myriophyllum*), 4 or 0; 4 or 2: 8, 4 or 2; 0 (male); 4 or 0; 4 or 0; 0; 4 (female). Water Star-wort, 0; 0; 1; 0 (male), and 0; 0; 0; 4 (female).

It will be readily seen how degraded these flowers are, losing calyx, corolla in nearly all, and the sexes becoming separated.

Having started with extreme simplicity in the flower of the Yew (fig. 84), the female consisting of nothing but an ovule, or as in a Pine, with one stamen and a carpellary scale with two ovules (fig. 85), we reached a highly complex condition in Salvias, only to return once more to such a flower as the Mare's-tail, consisting of a single carpel, embedded in a receptacular tube and surmounted by a single stamen (fig. 63), to a still simpler conditon in Spurges, whose male flowers consist of a single stamen only.

Thus, then, have flowers been both made and unmade.

ON THE CONSTRUCTION OF A VERANDAH.

By the Rev. W. Wilks, M.A.

(Vicar of Shirley, Surrey; Secretary R.H.S.)

In the year 1898 an illustration of my little country vicarage appeared in that most delightful of all weekly papers, *Country Life*; and immediately afterwards I began to receive enquiries on all sides, "How do you manage to get your house covered with creepers although you have a verandah?" The number of such enquiries, together with a few as to why "the width of the openings is not always the same," and so on, induced me to promise one or two Fellows of the Society that I would write them full particulars.

Verandahs are, I believe, very much more common in America, Australia, and the Cape than they are in England, but with this difference, that there they are for *coolness*; whereas in England, I think, they should be regarded more as shelters, enabling us to sit out of doors in spring and autumn—sometimes quite into the winter, and often till late at night—rather than during the very height of a hot summer's day. In England, as a rule, we want to lengthen out our summers, both at their beginning and their ending, rather than to lessen the sultriness of a very seldom occurring over-hot day, on which rare occasions a shady tree is more suitable than a verandah. There seems to me, therefore, to be this essential difference between a verandah in a hot country and in England—the one is for coolness, the other for shelter, I might almost say for warmth. I would never therefore recommend a verandah on the north side of a house nor on the east. It should always run round the south and west sides—round both, mark you—so that when a cold wind happens to set along one side you may bask in the sun upon the other. For the same reason the east end of the south side and the north end of the west side should always be closed in with glass. How useless a verandah is on the north side of a house I can testify from experience, as my vicarage has one, but I have never once sat under it in twenty years! and only retain it for appearance sake, as it masks an ugly wall.

Having fixed on the site, the next point is to fix on the material to use in building. And let me very strongly advise wood, not iron. Iron is bitterly cold in winter and very hot in summer. Many a creeper is killed by the extra intensity of the cold in winter on the metal, or by being literally roasted on one of our very few hot days in summer, which can occasionally be exceedingly hot. Iron, too, beautiful as it is in wrought-iron gates and hanging lamps, and even knockers, is not a suitable material for verandahs. The Goddess Flora altogether forbids any attempt at ornamental ironwork in her domains beyond the aforesaid gates and railings, where such things are needed. And oh! eschew, eschew an iron roof above all other things, however ornamentally (?) it

may be curved and finialled. Its heat is appalling on even a moderately warm day, and its cold in winter equally extreme. It is also almost impossible for the gardener to get about on it to nail up or to clip the creepers,

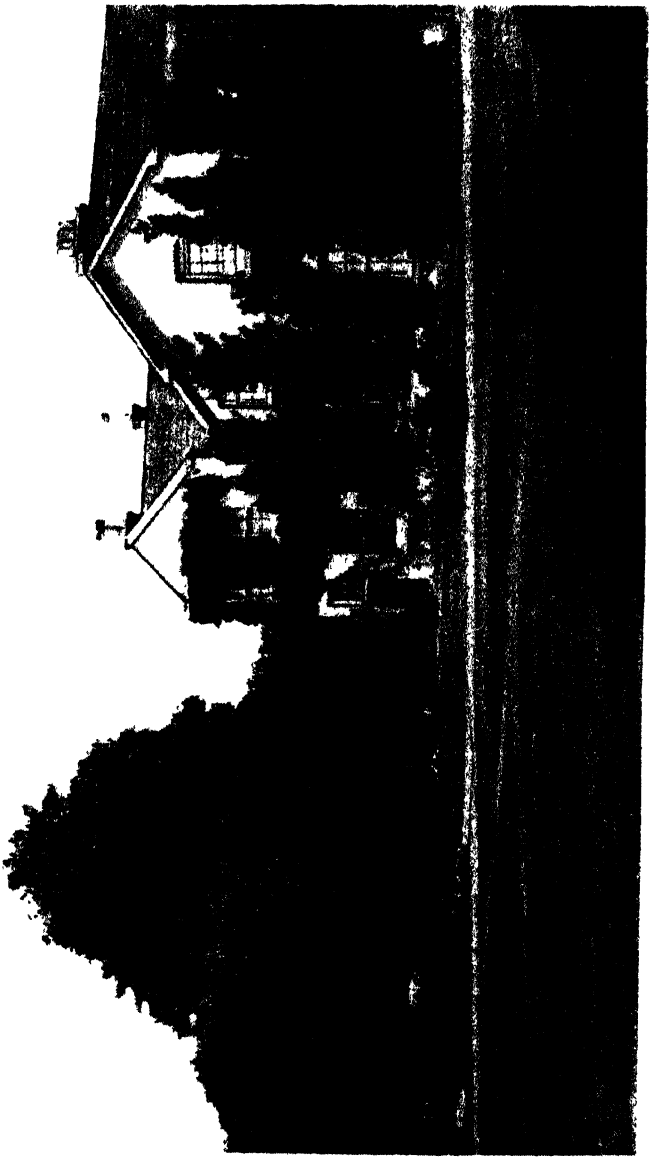


FIG. 64.—SHIRLEY VICARAGE—BEFORE THE VERANDAH.

The next point is that a verandah should be made of a sufficient width to allow of an 18 in. wide border all along the side of the house for flowers and creepers to grow in. But I had better now describe my own, beginning at the ground level. The total width from the house to

the outside edge is 8 ft. (see fig. 65), made up of 18 in. of border (A), with a slate edging (B) 1 in. thick, 5 ft. 9 in. of tessellated pavement (C) of hard tiles in simple pattern bedded on concrete, and finished off with 8 in. of stone curb (D) outside.

The total height of any particular verandah must be governed by the height of the windows, but as a rough guide, the extreme height should be about one foot above the windows of the ground-floor rooms. In my own case the total height is 9 ft. 7 in., the last seven inches representing the plate E resting on the iron bracket F. These iron brackets, of which the details are shown on fig. 66, are let into the wall and set in cement

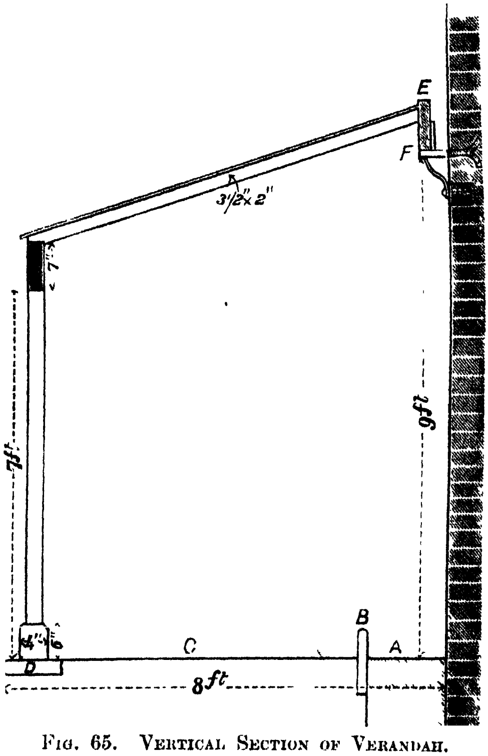


FIG. 65. VERTICAL SECTION OF VERANDAH.

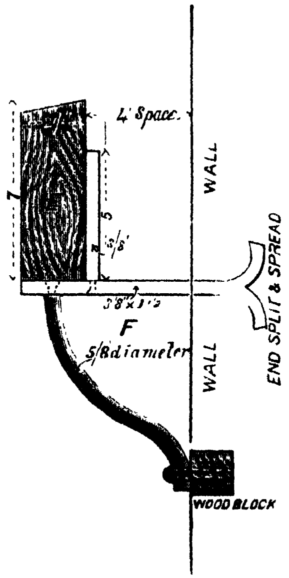


FIG. 66.—DETAIL OF BRACKET.

at convenient distances, according to the contour of the house, but at about six feet apart, and on them rests the plate E, which forms the back of the whole framework of the roof of the verandah. It will be noticed that this bracket keeps the plate E from coming back flat against the house, and leaves an open air-space of four inches wide for creepers to pass through, and for the heated air lying close under the glass to escape by. The brackets are made of flat wrought iron ⅜ in. thick and 1½ inch wide, and consist of a horizontal main piece about one foot long, the last three inches being split and turned out opposite ways to give a good hold in the wall. They should project altogether 6½ inches from the flat of the house, so as to leave the 4-inch space clear. An upright piece of the same iron is riveted into the last mentioned at the width of the plate—*i.e.* at 2½ inches from the front, to which the plate E is bolted

top and bottom. The whole of this is further supported by a bracket piece of ⅝ inch, round wrought iron, riveted into the horizontal main-piece, and firmly screwed into a wood block cemented into the wall. A great deal of the strength of the whole building depends on the construction and firm fixing of these brackets.

The next point to consider is the front supports of the roof. These, as will be seen in figs. 67 and 68, are mostly in the form of lattice work, the main frame of which is made of wood 2 inches wide by 2½ inches deep, rabbited in the centre to ½ inch, in which is fitted the lattice work, of ¼ inch by 1 inch stuff, as shown in fig. 67; the total width of these uprights is 15 inches. It will be noticed that the lower three feet consists of two divisions with simple diagonal crossbits 1¼ inch square. These uprights stand on stone blocks 6 inches high, 4 inches wide, and 16½ inches long, the top edge being bevelled all round. The front plate, resting on the top of these supports, is the same size as the back plate—viz. 7 in. × 2½ in., into which the rafters are mortised at 11½ inches from

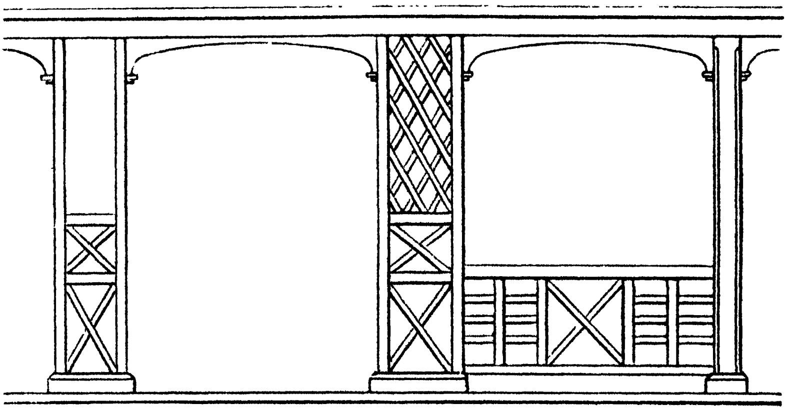


FIG. 67.—OUTLINE OF FRONT WOODWORK.

edge to edge. In my own case, in order to lighten the appearance, I have introduced one or two plain pillars of wood four inches square, instead of always repeating the lattice ones, where from the span of the arches the lattice supports would have come too close together. The spacing and span of the arches must always depend on the look-out required from the windows, the centres of the large arches or springs being kept opposite the centres of the principal windows.

The roof, as already mentioned, is made of rafters 11½ in. apart and 2 in. wide by 3½ deep; the heavy appearance of this depth is relieved by the lower part being moulded. The whole is glazed with rolled glass, each sheet being 1 ft. wide, and the whole length of the rafters from back to front to avoid drip at joints.

In order to guard against the possibility of rain getting through on to the windows of the house, it might be as well to let a strip of sheet zinc or lead into the wall exactly over the windows to cover the 4 in. air-space, unless the creepers are sufficiently thick, as in my own case, to make this unnecessary.

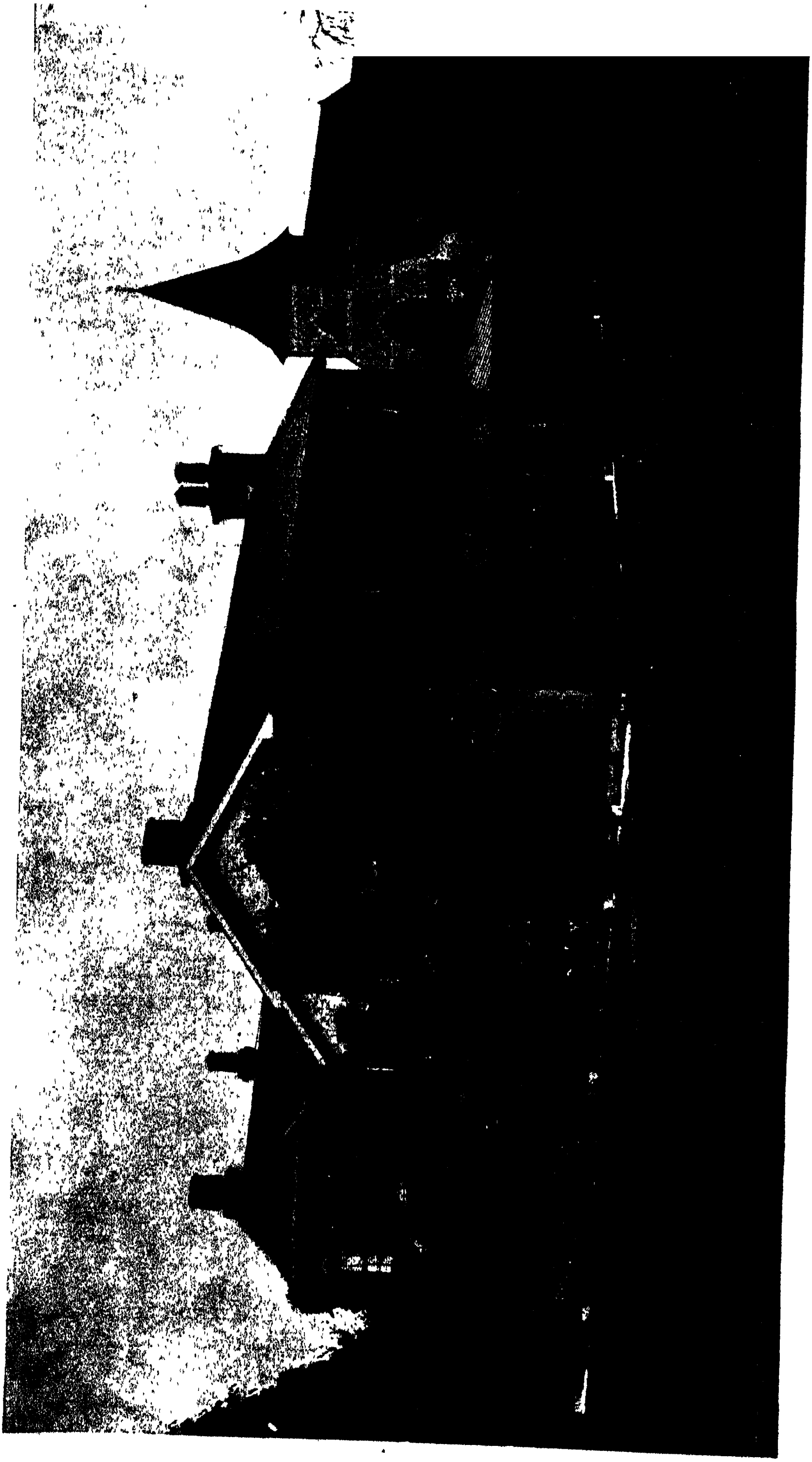


Fig. 68.—Shirley Vicarage. (*Country Life.*)

An outside border of about 2½ ft. between the lawn and the curb stone of the verandah is a great improvement, except in the case of such arches as are wanted for going in and out at, and to keep it from being walked on I have fixed a framework as shown in fig. 67 between the front supports, which is also very useful to train an outside lot of low creepers to. They also add stiffness and firmness to the whole structure.

By comparing the two views of my house, one, fig. 64, taken before, and the other, fig. 68, after the verandah was built, it will be seen how little (if any) damage was done to the existing creepers on the walls. I may add that the house is now entirely covered, as it is more than three years since fig. 68 was taken.

One word as to the colour of the paint to be used. No one should be dogmatic, as the colour is entirely a matter of taste, and I have no right to say my taste in such matters (or in any) is better than my neighbour's. I only, therefore, say what I personally like and dislike. I dislike intensely imitation oak—paint should not be ashamed of itself or try to pose as what it is not. Again, I think one single colour, and only one shade of it, should be used; there should be no attempt to ornament the wood work by different shades or colours of paint. There are two colours which always seem to me to harmonise well with plants—a warm nut-brown and seakale-leaf green. Both are, I think, good for the purpose. Myself, I have used the seakale-green, and many whose opinion is worth having have admired it. The colour when first put on must be a shade darker green than a seakale leaf, as the colour always fades a little at once.

FIG. 69.—CŒLOGYNE PANDURATA. (*Journal of Horticulture.*)

INCONSPICUOUS AND RARELY CULTIVATED ORCHIDS.

By W. H. WHITE, Orchid Grower to Sir Trevor Lawrence, Bart.

[Read March 26, 1901.]

ORCHID culture during the last quarter of a century has extended with great rapidity, due to the increased taste for and appreciation of this beautiful and interesting class of plants. But there has always been a general disposition among Orchid growers, not only in England but also abroad, to cultivate only the more showy genera of the great Orchid family. It is not my wish to attempt to persuade any who have not a real liking for the curiously constructed and "inconspicuous" genera, termed by some "Botanical Orchids," to enter on this branch of Orchid culture. For unless it be earnestly taken up, it would only result in disappointment and the loss of rare plants, the supply of which is all too limited to meet the needs of those who, having a taste for these little plants, find in them a real and ever-varying pleasure. It is said of Orchids that they, like domestic animals, soon find out whether they are under the care of those who really love them, and that they respond by thriving or failing accordingly. This may be said to be illustrated by the frail little genera in a marked degree. For while with care and attention a large proportion of them are fairly easy to cultivate, neglect for a very short time may bring about their loss. Still I would advise Orchid growers to give these plants a greater share of attention, even if that be confined to the careful cultivation of the few little curiosities which from time to time fall into their hands by being imported on masses of showier Orchids. In this way some few collections, whose owners formerly held the "inconspicuous" Orchids in contempt, now contain interesting and valued groups of them. Above these considerations, too, for one who cares for the singular waifs and strays of Orchid life, there is the knowledge that he is contributing in some degree to the cause of science. For out of such chance arrivals many a new genus or species has been recorded and described, and a still larger number of those previously described have by their appearance in gardens supplied herbaria with coveted material.

Perusal of any botanical work on Orchids discloses the fact that there are a very large number which are not at present in cultivation. Any of these may make an appearance at any time, if only in one or two specimens, and on the care which they receive on arrival depends the chance of their survival to be incorporated with the already cultivated garden Orchids. Most of the showier genera have among them modest representatives which may be classed with those I am attempting to commend, while genera such as Masdevallia, Cirrhopetalum, Bulbophyllum, Polystachya, Eria, Octomeria, Stelis, &c., are largely composed of what are called by some botanical curiosities. All these have interesting structural peculiarities, and some of them are a source of wonder to those who see them for the first time, and a source of lasting interest to those who care to make a study of them.

A COLLECTION of Orchids should properly aim at embracing the whole of this very large natural order of plants, made up of tribes and sub-tribes, of many genera, and a vast number of species. The Orchideæ may challenge comparison with any natural order in the beauty, colour, and diversity of their flowers. The natural order shows endless variety in modes of growth, epiphytal and terrestrial, in size, colour, shape, and mode of flower production, in peculiarities of fertilisation, &c. If an Orchid lover grows a SELECTION of these plants it will generally be one which consists mainly of the more showy genera, such as Cattleya, Lælia, Odontoglossum, Dendrobium and perhaps Cypripedium. Even then many very striking and large flowered genera will be neglected, such as Stanhopea, Houlletia, Acineta, Luddemannia, Gongora, Maxillaria, Schomburghkia, &c. Even such beautiful genera as Aerides and Saccolabium are now comparatively rarely seen in collections, though in the palmy days of the great Chiswick Shows they were prominent in exhibits, and were greatly admired.

It perhaps may be said that Orchid importers do not find it pay to import the smaller and less conspicuous members of the natural order, however strange or beautiful they may be. This might be so if it were necessary to send out collectors expressly or mainly to collect them. But the additional cost of including with Cattleyas and other New World genera such gems as Polycycnis or Sievekingia, and the rarer and choicer Epidendrums would be very small. So with the Old World, where collectors of Dendrobiums and Cypripediums would certainly come across lovely little Bulbophyllums, Cirrhopetalums, &c.

It comes then to this, that collectors would greatly add to the personal, as well as the scientific, interest of their Orchid collections if they were to include in them the smaller and less showy genera. They would in so doing be but following the example of collector in other branches of natural history, for example, entomologists, who do not disdain the smallest and least attractive of insects.

To go into particulars, let me say that out of the 168 species of Dendrobiums enumerated in the "Flora of British India," there are probably not more than one half in cultivation. Yet many of these rarely seen plants can easily be obtained from India by letter or parcel post.

The same applies to the genus Cirrhopetalum, of which many species are striking and beautiful. So again of Bulbophyllums, botanically nearly allied to Dendrobiums, the curious *Dendrobium amplum* of the Khasia Hills, and the Bornean *D. Treacherianum* being connecting links between the two genera. Bulbophyllum and Cirrhopetalum are so connected by cross affinities that the two genera are difficult to discriminate. Sir Joseph Hooker, in his "Flora of British India," says: "My keeping them apart is due to the consideration of convenience, and the fact that all my attempts to commingle the species of both have resulted in a chaotic aggregate with the most unsatisfactory sectional characters, in fact, a far less natural result than the keeping them apart." Among the most obvious characteristics by which Cirrhopetalums may be recognised are their small monophyllous pseudo-bulbs, produced from a scaly, creeping rhizome, their umbellate inflorescences, or rather racemes reduced to

umbels which are frequently one-sided, and their elongated parallel lateral sepals, which in several species, e.g., *C. Collettii*, *C. Medusæ*, and *C. Rothschildianum*, owing to a peculiar twist at their base, are brought into the same plane on their inner edges, so as to meet together like the wings of an insect.

The genus consists of upwards of fifty known species, many well worth cultivating. The greater part of them are East Indian, growing among the Himalayas and other mountain ranges. Some inhabit the Malay Archipelago, one, *C. Thouarsi*, is reported from the Mauritius, and another, *C. chinense*, from China. Dr. Lindley, in his description of the last-named species, added the following note:—

"There is no longer any occasion for speculative minds to occupy themselves with the investigation of the cause that may have led the Chinese to invent strange figures of men and women with their chins perpetually in motion, for here is the explanation of it. We have here a plant from China, one of whose lobes is exactly like a tongue and chin, which are so unstable as to be in a state of continual oscillation. The flowers are arranged in a circle, and all look outwards, so that on whatever side the umbel is regarded it still presents to the eye the same row of grinning faces and wagging chins."

Cirrhopetalum Medusæ is another curious and interesting species. The scape is erect and bears upon its apex a large, dense, globose cluster of flowers, which are cream-coloured, freckled with pink, two sepals of each flower being so much lengthened out as to give the spike the appearance of a head with very long, dishevelled hair, a circumstance which caused Dr. Lindley in his description to remark:—

"Certainly, if ever there was a Medusa, this must be the prototype before her beautiful tresses were exchanged into serpents. Nor are wanting the scales with which her form was safely guarded." *C. Medusæ* was introduced from Singapore by Messrs. Loddiges in 1841. The large plant now in the Burford Collection, which was illustrated in the *Gardeners' Chronicle* in 1897, came originally from Lady Dorothy Neville's Collection about the year 1878. There are many varieties among the Cirrhopetalums which are not only curious but handsome in appearance. Such is the plume-bearing *C. Rothschildianum*, a species which was awarded a **F.C.C.** by this Society, an honour only twice before accorded to members (*C. ornatissimum* and *C. robustum*) of this singular genus. The prevailing colour of the flower is bright crimson purple, blotches of clear yellow appearing on the sepals, the triangular-grooved hinged labellum being purple, and the whole flower so attractive that it commands attention even from those who do not appreciate "inconspicuous" Orchids. Its nearest affinities are *C. Collettii*, *C. ornatissimum*, and *C. appendiculatum*, with its gem-like appendices. The last-named is probably the only single-flowered Cirrhopetalum known. A few interesting representatives of the umbellate section may here be enumerated, viz., *C. Mastersianum*, the umbrella-like spread of its brown satiny sepals having caused a noted Orchidist to remark to me that it reminded him of the parasol of a Liliputian belle; *C. O'Brienianum*, *C. picturatum*, *C. Roxburghii* (fig. 70), *C. gracillimum*, and *C. Cumingii*, with flowers arranged like tiny pink parasols. When stood upon the ground each umbel of this last plant looks as if a caterpillar

were curled over its surface. It is closely allied to *C. fimbriatum*, though the colour of the flowers (which are of a warm reddish purple) is far more brilliant and attractive. The upper sepal of *C. fimbriatum* (fig. 71) and the petals are fringed round their margins with long glandular hairs. The fleshy

Fig. 70.—Cirrhopetalum Roxburghii

lip has two erect longitudinal keels, and is attached by a very slender bristle, the balance being so nicely adjusted that a slight touch sets the whole of the lips in the umbel oscillating in a very curious fashion. A compact plant of *C. nutans*, smothered with umbels of small white flowers, makes a charming object. *C. refractum* is known as the

"Windmill" Cirrhopetalum. It has a raceme of golden-yellow flowers, which are arranged around the top of the spike so as to be sensitive to the slightest current of air. Cirrhopetalums are all dwarf in habit, and thus occupy but little space, especially as they thrive in teak-wood baskets

Fig. 71.—Cirrhopetalum fimbriatum.

or shallow pans suspended close to the roof, in which position their umbrella-shaped trusses of singular flowers are displayed to the best advantage. The baskets or pans should be filled to about three-fourths of their depth with clean crocks or charcoal, the advantage of charcoal over crocks consisting in its lightness. Place a layer of moss over the

drainage, then put in the plant and fill up to the rhizome of each plant with good fibrous peat and a little sphagnum. These plants enjoy an abundant supply of water, and during the growing season must be taken down two or three times during the week and receive attention as to their requirements. In winter they need but little water, yet care must be taken to avoid the shrivelling of the pseudo-bulbs, or the plants will be permanently injured. Cirrhopetalums generally thrive well in the warmest house, but should any plant show signs of ill-health, remove it to the intermediate house. These plants should always be kept on the shady side of the house, as they resent sunshine while appreciating light.

These cultural remarks apply also to the Bulbophyllums, of which many are striking and beautiful. This genus consists of a very large number of species known to science, and anything like a full reference to the genus would greatly exceed the time at my disposal. Its geographical range is very extensive, probably spreading over a larger area than any other Orchid genus. The greater number of Bulbophyllums come from East India and the Malay Archipelago, but many are found in Africa, Madagascar, and even in Australia and New Zealand, where *B. pygmæum* has its home. Three species of Bulbophyllum—*B. grandiflorum*, *B. Hamelinii*, and *B. Beccarii*—cannot be classed as "inconspicuous" Orchids, the latter being in size the giant of the genus, its enormous rhizome encircling the trees to which it is attached like the coils of a serpent. Its flowers have an odour unpleasant enough to exclude it from general cultivation, the fœtor rivalling that of *Aristolochia gigas*, Stapelias, &c. Many of the known Bulbophyllums have undoubtedly proved objects of marked interest, even where the more showy species of other genera hold sway. Prominent among them is the remarkable *B. barbigerum* (fig. 78, on large plate). I cannot do better to convey an idea of its peculiarities than by again quoting Dr. Lindley's description: "The lip is one of the most extraordinary organs known even among Orchidaceous plants, the very long purple threads forming the brush at the point of the lip are so excessively delicate that the slightest disturbance of the air sets them in motion, when they wave gently to and fro like a tuft of threads cut from a spider's web. Nor is this all; the lip itself, with its yellow felt, its two beards, and its long purple brush, is articulated with the column by such a very slight joint that to breathe upon it is sufficient to produce a rocking movement, so conspicuous and protracted that one is tempted to believe that there must be something of an animal nature infused into this most unplant-like production."

Bulbophyllum comosum is found in Eastern Burmah, on the Shan Hills at an altitude of 6,000 ft. The stout ascending scapes are furnished at the top with drooping racemes of closely set small white flowers, each measuring about half an inch in length, and covered with short hair-like processes, the whole head having a resemblance to a bottle-brush. It belongs to the deciduous section, the members of which require to be dried off for a time after the leaves fade, as do *B. hirtum* and *B. auricomum*. A peculiarity of this section of Bulbophyllums is that the entire plant, leaves (especially when drying or dried), and flowers have a delicate but strong odour of new-mown hay. The flower of *B. auricomum* is, owing to its pleasant fragrance, a great favourite with

the Burmese ladies, who decorate their hair with it. Others which are well worth space in our houses are *B. Ericssoni*, *B. tremulum* (fig. 72) (with a peculiar sensitive hairy lip resembling a hand brush), *B. Sanderianum*, *B. Watsonianum*, *B. Dayanum* (fig. 73), &c.

FIG. 72.—BULBOPHYLLUM TREMULUM.

Very singular too is the movable lip of such plants as *Bulbophyllum (Sarcopodium) Lobbii*, *B. Dearei*, *B. siamense*, and *B. Sillemianum*. The labellum in these cases is so constructed that with very slight motion it is thrown backward and forward as though it were set upon a delicate hinge.

Another curious and interesting section of "inconspicuous" Orchids are the Megacliniums (fig. 73), which are closely allied to the Bulbophyllums. The strong growing *M. triste* produces an erect spike, the rhachis at its apex having the appearance of a snake in the act of striking, on each side of which are borne small blackish flowers in alternate pairs. As regards *M. Bufo* the late Dr. Lindley made the following remarks: "Let us imagine a green snake to be pressed flat like a dried flower, and then to have a row of toads, or some such speckled reptile, drawn up along the middle in single file, their backs set up, their four legs sprawling right and left, and their mouths wide open, with a large purple tongue wagging about convulsively, and a pretty considerable approach will be gained to an idea of this strange plant, which, if Pythagoras had but known of it, would have rendered all arguments about the transmigration of souls superfluous."

In Australia there are many epiphytal and terrestrial Orchids well worth growing, "inconspicuous" it may be, but of much interest. Few of these have, I believe, ever been seen in this country under cultivation. The terrestrial genera Caladenia, Diuris, Pterostylis, &c., and the epiphytal genus of Sarcochilus, of which *S. Fitzgeraldii* and *S. Hartmannii* (fig. 74) only are known to most of us, are strangers in European collections. There are also in Australia several very pretty Dendrobiums which may also easily be sent home by post, as *D. teretifolium*, *D. linguiforme*, *D. monophyllum*, *D. tetragonum*, and *D. canaliculatum*. When well cultivated, these species produce small but interesting flowers in great profusion.

When we come to our South African Colonies, how many Disas are there which have never been seen in cultivation? Mr. Bolus, in his "Orchids of the Cape Peninsula," and in his "Orchids of South Africa," Vol. I., states that there are 109 admitted species of Disa, of many of which he gives plates in the volumes referred to.

The now well-known volumes "A Century of Indian Orchids," by our distinguished Fellow, Sir Joseph Hooker, and the "Orchids of the Sikkim Himalaya," in five parts, by Sir George King and Mr. Robert Pantling, are perfect mines of wealth for the seeker after curious, beautiful, and little known Orchids, very many of which have never been seen in cultivation in Great Britain. The "Century" contains plates of eighteen Dendrobiums, of which only a few (*D. candidum*, *D. stuposum*, *D. ericæflorum*, and *D. Williamsonii*) are known to Orchid growers in the living state. Altogether there are 101 plates in this remarkable work, consisting chiefly of rare "inconspicuous" Orchids. These include varieties of such well-known genera as Aërides, Calanthe, Cœlogyne, Cleisostoma, Eulophia, Eria, Habenaria, Liparis, Luisia, Pogonia, Saccolabium, Sarcanthus, and many others which, although long known to Science, are practically unknown to us, and would undoubtedly, if obtainable, prove valuable and interesting additions to a varied collection. One Orchid figured therein I may mention as being particularly applicable to my subject, e.g., *Saccolabium* "*inconspicuum*." The other work, "The Orchids of the Sikkim Himalaya," contains plates of many species of Dendrobium which are strangers to us, and among other genera there are beautiful and interesting species of the following:

Habenaria, Calanthe, Cymbidium, Eria, Eulophia, Liparis, Luisia, Microstylis, Oberonia, Pogonia, Pachystoma, Saccolabium, Sarcanthus, Sarcochilus, &c. The same work contains plates and descriptions of many genera wholly unknown in cultivation. These make us dissatisfied

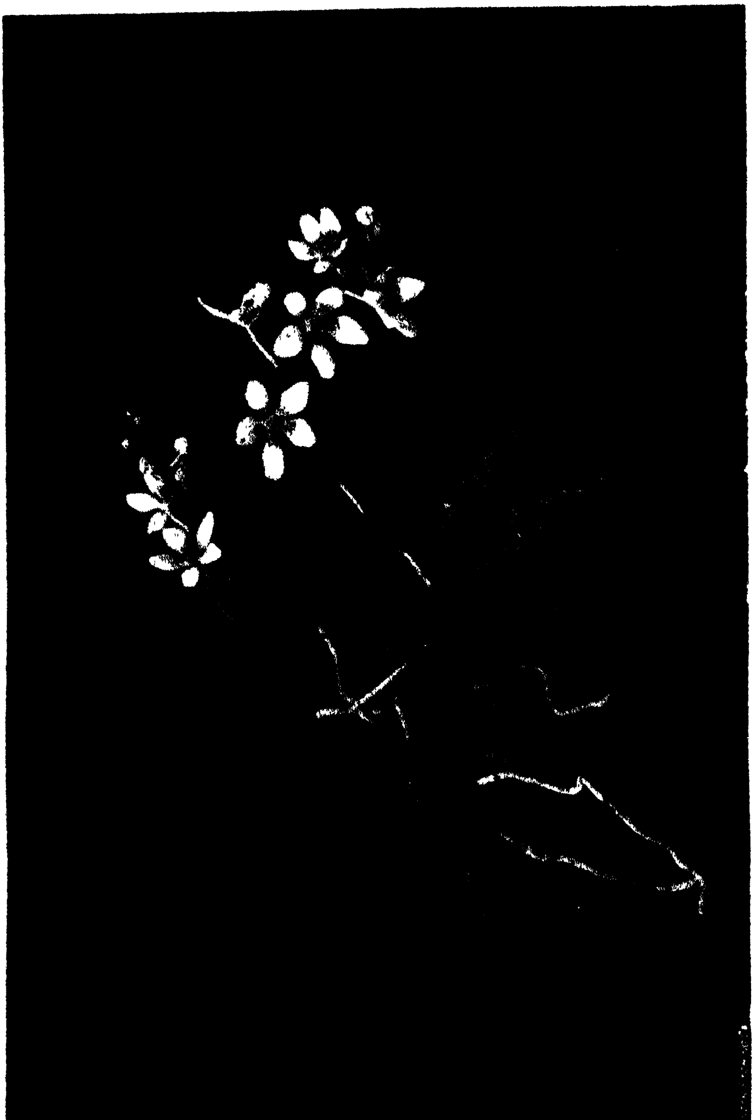


FIG. 74.—SARCOCHILUS HARTMANNII.

and make our mouths water. Now that tea and cinchona are so largely grown in the Himalayas, there are many European residents of intelligence interested by their vocation in gardening whom we might hope to enlist in the work of collecting Orchids growing in and about their gardens. At Burford, several times, interesting plants have been so

obtained. So it is with South Africa, which will probably, when the war is over, be the home of many educated British Colonists who could help us in this work, as, without doubt, Africa is far from being exhausted of its novelties.

As an example of collecting and sending home Orchids by residents in foreign countries, I may here mention the name of Mr. Lehmann, who has during a quarter of a century of travels in the Andes of Colombia and Ecuador sent home, among other treasures, many rare and "inconspicuous" Orchids, including several genera new to science, such as Sievekingia (Gorgoglossum) and Trevoria, both of which have been fully described in various botanical works. As a genus Trevoria is very characteristic and distinct. Its nearest neighbours are Coryanthes, Schlimia, Stanhopea, and Sievekingia; but it is distinguishable at first sight from any of them. At the end of 1893 Mr. Lehmann discovered another new genus, which was named *Serrastylis modesta* by Mr. Rolfe. The *Gardeners' Chronicle* remarks that this curious Orchid should have escaped detection by the many plant-collectors who have passed over the Cauca seems a singular circumstance, and the fact itself should give hope to the amateurs of novelties who are content with simple beauty and curious structure. The remarkable and pretty *Polycycnis Lehmannii*, also one of Mr. Lehmann's discoveries, belongs to a genus which consists of a highly curious section of Orchids very seldom met with in cultivation. *Polycycnis vittata* was the earliest known species, having been described by Dr. Lindley in 1841 under the name of *Houlletia vittata*. But the genus Polycycnis was established by Professor Reichenbach in 1855, the name being derived from πολύς and κύκνος, in allusion to the flowers on the raceme having a slender, gracefully curved column, like the neck of a swan. In fact, the genus is closely allied to Cycnoches, though at present it has not been known to play such a singular freak as the production of sometimes one form of flower, sometimes another different one, occasionally developing both forms at once! Polycycnis has the more general appearance of Gongora than of any other genus, though its free upper sepal readily distinguishes it, in Gongora the upper sepal and column being united for some distance, one appearing to arise from the other. The flowers are numerous, and borne in long, more or less arching, pendulous racemes from the base of the pseudo-bulbs.

Few groups of plants produce such remarkable and interesting flowers as the quaint Catasetums, Mormodes, Cycnoches, and Coryanthes. Of their curious distinctiveness, the wonderful apparatus of the flowers for securing fertilisation by insect agency, details of structure, cultivation, &c., a great deal may be written.

A passing reference may be made to the Columbian Masdevallias (fig. 73), which are now out of fashion, but which for beauty of colour, grace of form, and striking development yield to few genera. Such dwarf-growing species as *M. Wageneriana*, *M. Estradæ* (fig. 75), *M. melanopus*, *M. floribunda*, *M. hieroglyphica*, *M. picturata*, *M. O'Brieniana*, *M. ionocharis*, &c., may well be termed "inconspicuous" Orchids, but when well cultivated they flower freely and form lovely objects. In *M. Troglodites* we have a very singular little plant and a profuse bloomer. The column and lip have a resemblance to a grotesque figure concealed in the cavity

of the perianth, hence the name "troglodite." It is a native of New Grenada.

No plant in the whole Orchid genera excites more curiosity, surprise, and interest than *Masdevallia muscosa*, remarkable for its mossy

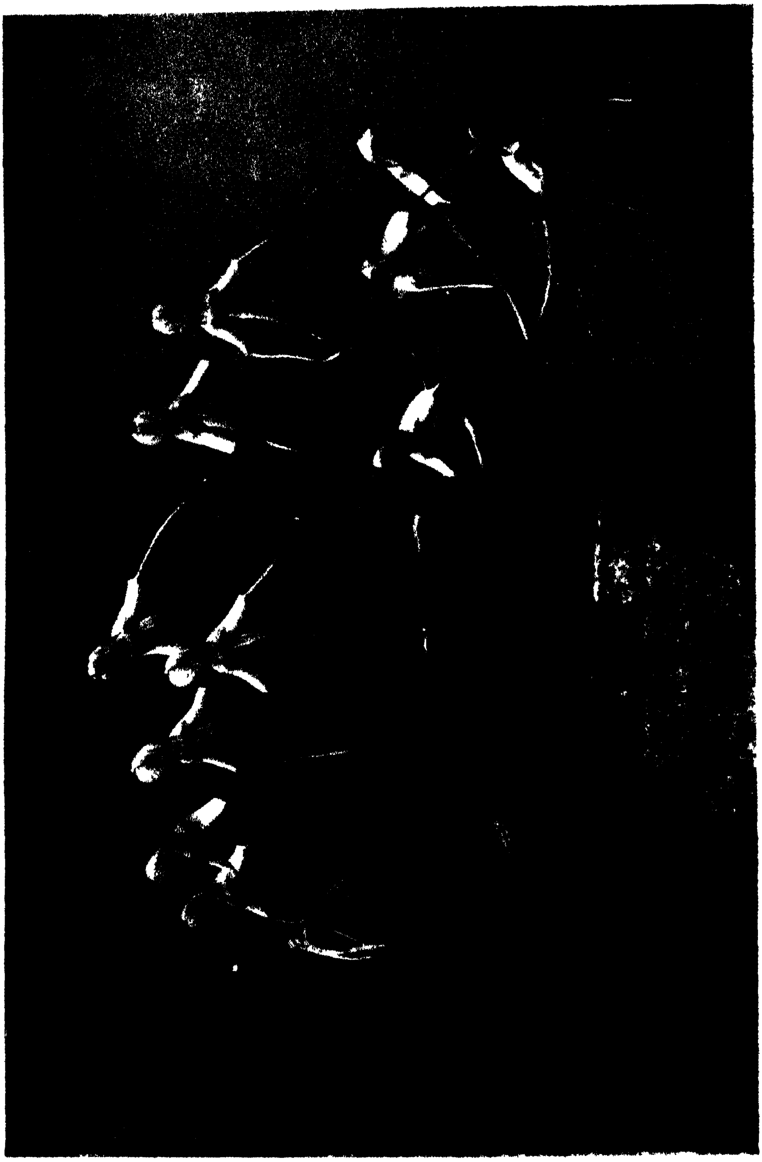


FIG. 75.—MASDEVALLIA ESTRADÆ.

peduncles and the extraordinary sensitiveness of its labellum. Upon the slightest touch of a tubercle at its base, the lip, at first slowly, then suddenly, closes itself upwards towards the column, where it remains fixed for about half an hour and then descends. This arrangement is evidently connected with the fertilisation of the flower, and its effect

would be temporarily to imprison an insect which had crawled over the tubercle. As an example of vegetable mechanism interesting to everybody, nothing could be more striking than this.

An interesting addition to the group is the new *Masdevallia deorsa*,

FIG. 76. - PLEUROTHALLIS ROEZLII.

another of Mr. Lehmann's introductions from Colombia. It has the unusual habit of growing head downwards, hence the name. *Masdevallia Culex* is now known under its proper name of *Pleurothallis macroblepharis*. It will be seen by the plant here exhibited that it is an "inconspicuous" Orchid, its flower bearing a fanciful resemblance to a gnat *Pleurothallis*

Roezlii (fig. 76) produces flowers which, when held up to the light, are most richly coloured. This photograph was taken from probably the finest specimen in cultivation, grown by Herr Otto Frœbel, of Zürich. There are probably nearly 400 species of Pleurothallis known to science, natives of the mountains of Tropical America at a considerable elevation. The

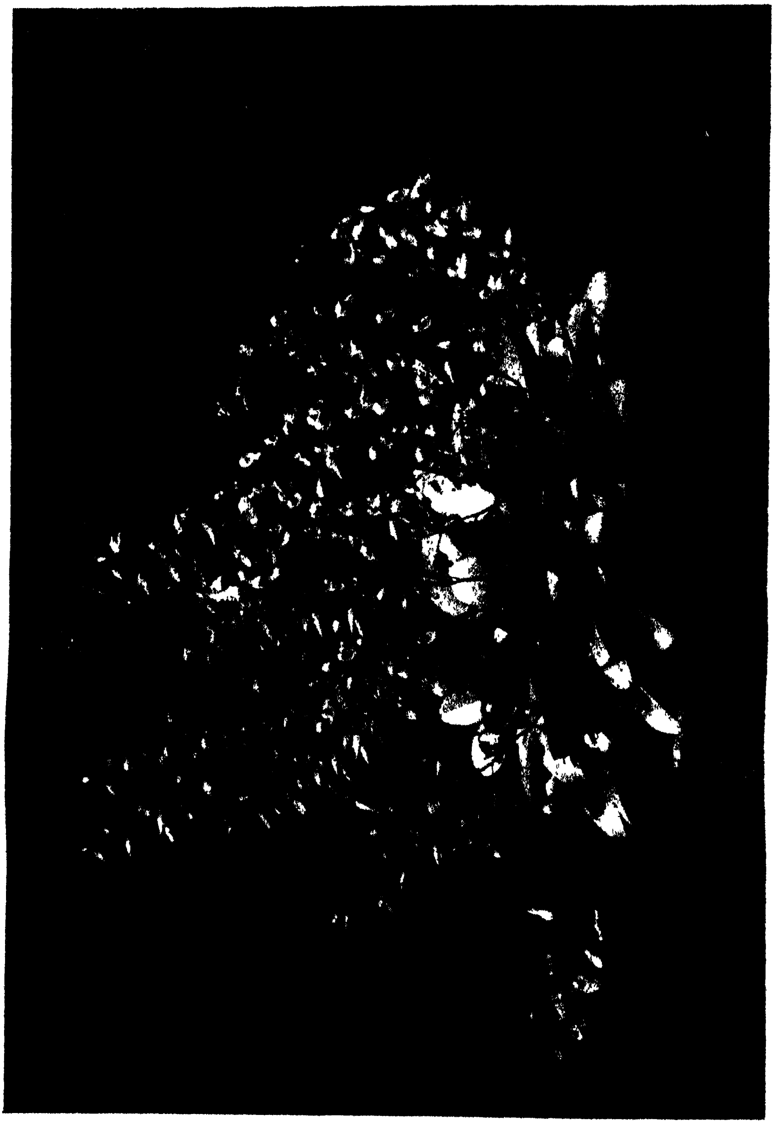


Fig. 77.—Pleurothallis Grobyi.

flowers of most of them are "inconspicuous," but many are of singular form and gem-like beauty (figs. 77 and 78).

The genus Restrepia is very closely allied to Pleurothallis, but it is distinguished by having four pollen masses, the latter having but two. *Restrepia antennifera* is the largest of the species known. It was

discovered by Humboldt near Pasto at an elevation of 9,000 ft. The flowers, which are borne singly on slender pedicels, are nearly 4 in. in length, the petals and dorsal sepal are lance-shaped, attenuated into

FIG. 78.—PLEUROTHALLIS ORNATA. (MAGNIFIED EIGHT TIMES.)

slender tails, which have a remarkable resemblance to the antennæ of some butterfly. The conspicuous lateral sepals are coherent, boat-shaped, and of a yellow colour, dotted with red-purple. *Restrepia elegans* is

a pretty little plant: its flowers very much resemble the preceding species. *R. leopardina* is very distinct, the lateral sepals rich yellow with

FIG. 79.—ANGRÆCUM SANDERIANUM.

numerous dots. The flowers of Restrepias, when viewed through a strong lens, are of great brilliancy, and form one of the most attractive of floral

objects. About twenty species are known, and all are remarkable for the above characteristics.

Owing to the short time at my disposal for reading this paper no mention has been made of the numerous species of Aërides, Angræcums (fig. 79),

FIG. 80.—PHYSOSIPHON LODDIGESII.

Vandas, Phaius, Ansellia, Zygopetalum, Sobralia, Miltonia, Cypripedium, Oncidium, Odontoglossum, &c., nor of such neglected genera as Arpophyllum, Æranthus, Anæctochilus, Cœlia, Comparettia, Cyrtopodium, Galeandra, Polystachya, Schomburghkia, Stanhopea, Octomeria, Hexisea,

Stelis, Physosiphon (fig. 80), &c., among which are many rare and "inconspicuous" species as yet uncultivated.

As regards cultivation, some of the Orchids referred to in this paper are at present difficult subjects. All the more reason for persevering with their cultivation. It was years before the cultivation of many Orchids which now grow to perfection in our houses was understood. In regard to some we have undoubtedly retrograded. Where, for example, do we find the grand specimens of Saccolabiums which were not uncommon in the first half of the last century? But the smaller and less showy of the natural order present no greater difficulties than their larger and more pretentious brethren. Only it must not be supposed that, as mentioned in the early part of my paper, because they are small they can do without care and attention. An intermediate house temperature throughout the year is desirable. In conclusion, I have tried to show that it is not for their beauty alone that "inconspicuous" Orchids are to be admired, but for the marvellous structure of the flowers, and the wonderful contrivances that are to be found in them to secure the end for which they have been created. I hope that they will be more generally cultivated. Amateurs may object that none of them are suitable to grow for cutting purposes or for indoor decoration; but I trust they will look to the future, when the endless variety and curious characteristics of the smaller Orchids may sustain an interest in the natural order, after fashion has discarded the showy species now in favour.

N.B.—An aluminium watchmaker's glass, to be held in the eye, is a valuable help to the appreciation of the beauty of small flowers, as well as for the detection of nascent fungoid and insect plagues

OBSERVATIONS ON SOME OF THE PLANTS EXHIBITED.

By the Rev. Professor GEO. HENSLOW, M.A., V.M.H.

[April 9, 1901.]

CHRYSOGONUM VIRGINIANUM.—A small yellow-flowered composite, not uncommon in the United States of America, was in Mr. Jackman's collection. It is interesting as mimicking some such flower as a Potentilla, in consequence of the ray florets of the head, instead of being numerous, as in a Daisy, being reduced to five only, but these are provided with rather large corollas.

NEW ZEALAND VERONICAS.—Mr. Peed exhibited some species of this genus, so largely represented in New Zealand. While our own Speedwells are little herbs, such as the "Germander," with its bright blue flowers, the New Zealand species are shrubby. The larger-leaved kinds, often seen in gardens, are *V. speciosa*, *V. salicifolia*, and many hybrids. These grow to considerable size and frequent the less mountainous regions; but the species exhibited are dwarfs, growing at various altitudes in the New Zealand Alps up to 6,500 ft. Thus, *V. buxifolia* ranges from 1,500 ft. to 8,000 ft. and upwards. It resembles our box, hence its specific name. *V. cupressoides*, with closely adpressed leaves, like those of the Cypress and Thuyas, forms dwarf plants ten to eighteen inches in height; it grows up to an elevation of 4,000 ft. *V. Hectori* and *V. lycopodioides* occur up to at least 4,000 ft. *V. pygmaea*, as a bush, descends to 4,000 ft., but has been found as high as 6,500 ft. To compare with these, a small plant of *Juniperus hibernica* of Mr. Barr's was shown, having a miniature form of foliage. It is interesting to know that the young state of *Podocarpus dacrydioides* of New Zealand was actually described by Sir J. Banks and Solander as *Lycopodium arboreum!* The general deduction is that these curious forms of foliage are simply adaptations in different plants to the same climatical conditions, though often of widely separated countries.

SANTOLINA CHAMÆCYPARISSUS. This is best known as Lavender Cotton, a misleading term, as it has nothing to do with lavender, nor indeed with cotton, being a composite allied to our Yarrow. It is not uncommon in dry districts of Europe, having minute inrolled leaves, so characteristic a feature in desert plants; the object of this is to reduce the loss of water by transpiration. This is aided by the felt-like or cottony hair, also a feature of several desert plants. This clothing also aids in absorbing dew, which is heavy during the many months when no rain falls in such regions.

DOUBLE AND MULTIFOLD FLOWERS.—Some specimens of Hyacinths and Tulips from Mr. Jones's collection exhibited these peculiarities. Mr. Henslow first pointed out that "twin" flower stalks with "synanthic" flowers consisted of a natural grafting of two individuals, and that when this is the case the united flowers *lost* certain parts. Thus a twin *Eucharis* had its two flowers pertamerous instead of hexamerous. In the case of a "fasciated" stem, terminated by a "multifold" flower, both of these parts of the plant arise from a constant bifurcation of the woody cords or fibro-vascular bundles in the stem, without any branching at all. This produces the well-known flattened stem. In the case of the flower, the

set of cords which should contain the definite number of petals, stamens, &c., give rise to numerous branches; then these branches, on issuing from the floral receptacle, are clothed with tissue, thereby making extra petals or stamens, &c., as the case may be, so that such a flower is not the result of the fusion of two or more individuals, but is a single flower with multifold parts. Such flowers are sometimes hereditary, as in the case of Tomatos, the Forget-me-not, known by the names 'Victoria,' 'Jewell,' &c., and the Foxglove, terminated by a campanulate multifold blossom, which the late M. H. Vilmorin succeeded in fixing, to the amount of 90 per cent.*

JAPANESE MAPLES.—Mr. Wallace showed some forms of *Acer polymorphum* of Japan with variously cut leaves. The English Maple (*Acer campestre*) has five principal lobes, but in *A. Pennsylvanicum* of U.S. there are only three. This resembles the fossil leaves found at Œningen, of the Miocene epoch, called *A. trilobatum*. The lobes were only serrated at the margins, not deeply toothed. Its fruit was very small, and not unlike that of *A. rubrum* of North America. In *A. Pseudoplatanus* there is a tendency to separate a lower pair of lobes from the others. This species, called the Sycamore Maple, is often attacked by a fungus (*Rhytisma acerinum*), which makes large black spots on the leaf. It is interesting to find the fossil leaves similarly blotched by an allied fungus called *R. induratum*. In Japan there are one or more species with single unlobed leaves, as *A. carpinifolium* and *A. distylum*, &c. These represent the most primitive type of foliage. The three—and then the five—and finally the many-lobed forms of *A. polymorphum* represent the line of evolution in the genus *Acer*. Lastly, in the variety *A. p. dissectum* all the segments are quite distinct, making a truly compound palmate leaf; while in *Negundo fraxinifolia* we also reach a perfectly compound but pinnate leaf.

PELARGONIUM INQUINANS.—Mr. Cannell's magnificent collection of Scarlet Geraniums, as they are improperly called, illustrated the vast improvements made in the flower since 1714, when it was introduced from C. G. H. The wild plant has a small scarlet flower, with petals like windmill sails, having great gaps between them; whereas the present plant has a flower with a perfectly circular outline. This is an attempt at reversion to regularity, which all irregular flowers originally possessed; thereby approximating to a Geranium, which has a perfectly regular pentamerous flower of five sepals, five petals, ten stamens in two whorls of five each, and a pistil of five carpels. Five honey-glands are symmetrically situated on the floral receptacle; whereas in Pelargonium a long tube at the posterior side of the flower, running down the stalk, contains the honey. There are also only seven perfect stamens; so that, under cultivation, the flower of a Pelargonium tends to reacquire the character of Geranium, from which, or some similar form, it was probably descended.

TRILLIUM.—This genus, like our British wild flower *Paris quadrifolia* and *Arum maculatum*, is remarkable for its net-veined leaves. If the theory be true, that Monocotyledons, to which these genera belong, have descended from aquatic Dicotyledons, the reticulated venation of Trillium, &c., may indicate a reversion or retention of an ancestral type of leaf.

* Further details on this subject will be found in the following paper read before the Scientific Committee of the Society.

FASCIATION AND ALLIED PHENOMENA.

By Rev. Professor G. HENSLOW, M.A., &c.

[A Paper read at the Scientific Committee, April 9, 1901.]

FASCIATED STEMS.—Fasciation is a word derived from *fascia*, a bandage, and is suggestive of the *fasces*, a bundle of rods tied round an axe which the lictor carried before the chief magistrate at Rome, the rods indicating the scourging of criminals, and the axe, beheading.

The term was invented by Linnæus, who regarded a fasciated stem as being "the result of the formation of an unusual number of buds, the shoots resulting from which became coherent as growth proceeded."*

Dr. Masters follows Linnæus in observing:—"If it happen that an unusual number of buds be formed in close apposition, so that they are liable to be compressed during their growth, union is very likely to take place, the more so from the softness of the young tissues. In this way it is probable that what is termed fasciation is brought about." †

M. Moquin-Tandon would refer fasciation to a flattening of a single

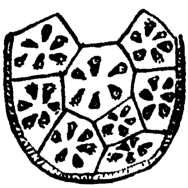


FIG. 81.—Transverse section of a portion of stem of *Narcissus Tazetta*, just below the umbel.

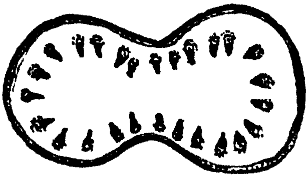


FIG. 82.—Transverse section of stem of twin Eucharis.

stem, and not to a combination of several axes; and observes that a cross-section gives an elliptical and uniform series of fibro-vascular bundles,‡ with a central path or canal. The following observations will, I think, prove that M. Moquin-Tandon is right so far; but he does not appear to account for the peculiar structure of fasciation.

If the fasciated stem were compounded of several axes, one has grounds for presuming that the vascular arrangements would indicate it, for if a cross-section be made of the peduncle just below the insertion of the pedicels of the umbel of *Narcissus Tazetta*, all the pedicels are there already marked out and represented by six cords in each, but surrounded by a common epidermis. (Fig. 81.)

Secondly, when two stems are naturally coherent, as in a specimen of a Eucharis in the writer's possession, there is an *arrest* of the cords along the line of junction, but the others form two arcs, so that the figure in a cross-section is that of an hour-glass. (Fig. 82.)

If the flowers cohere as well as the stalks, the arrest of cords is

* *Teratology*, by Dr. M. T. Masters, p. 15. † *Op. cit.* p. 11.
‡ As this phrase is cumbersome, I shall call them simply "cords."

continued up into the ovaries. Thus fig. 83 represents a cross-section of the ovaries of the twin Eucharis, in which it will be seen that there are only ten cords instead of the normal number, twelve. The two which should be on the line of union are wanting and represented by O's. The consequence was that the two coherent flowers were pentamerous instead of being hexamerous.

A fasciated stem, if theoretically composed of several stems, should

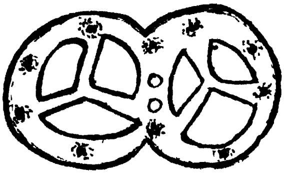


FIG. 83. Transverse section of ovaries of twin Eucharis.

FIG. 84 Transverse section of base of stem of a young Cockscomb.

have them indicated by constrictions, as in fig. 82; but it has no such indentations to mark off each of the combined axes.

Lastly, if the fasciated stem consisted of coherent shoots, it would be expected to become *smaller* in diameter upwards, as each shoot, being naturally conical in form, terminated upwards in succession. On the contrary, the stem often increases much in size, as is familiar to all in the Cockscomb.

The external striæ were supposed to represent "the lines of junction" :* but they are far too numerous, and are not simple cords from end to end, but often branching.

If we study the anatomy of the stem of a young Cockscomb, the lowest part has a perfectly normal circle of cords, forming the usual cylinder. (Fig. 84.) These cords continually branch and increase the number, as seen in higher sections. (Figs. 85, 86.) The diameter of the stem at the

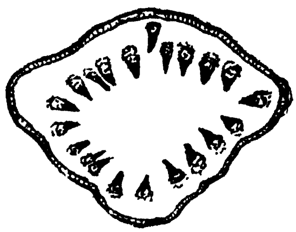


FIG. 85.—Transverse section of middle of stem of same.

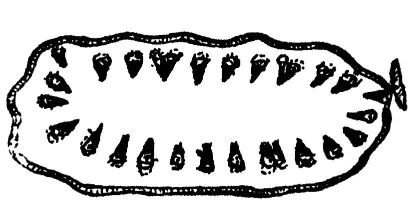


FIG. 86.—Transverse section of upper fasciated part of same.

same time enlarges, being somewhat quadrangular, but finally it assumes the usual flattened form. From time to time a cord passes off to enter a leaf (figs. 85, 86); but those which would normally go to supply the axillary bud fail to put in an appearance.

So that instead of their appearing externally as the cylinders of freely growing branches, they keep augmenting the size of the stem by bifurcation

* Masters, *op. cit.* p. 16.

Hence the base of the stem has a smaller diameter than is found higher up.*

We thus see that a fasciated stem is correlated with repeated bifurcation of the cords (fig. 87), or what used to be called "Chorisis." This is a somewhat misleading term, as it etymologically signifies "splitting," whereas the elements of the cord are all present in each branch, being the

FIG. 87.—Fibro-vascular bundles or cords of fasciated part.

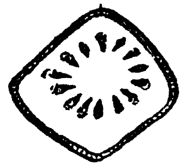


FIG. 88. Transverse section of stem of *Lathyrus pratensis*.

result of bifurcation, and consist of a bundle of xylem united to a bundle of phloëm. It is, however, a convenient term to retain.

Simultaneously with the branching of the cords of the stem, the cortical region increases so that it becomes larger; but why the cords usually increase in number in *one plane* and not *all round*, so as to retain a cylindrical stem, showing a circular section of cords, is not at all clear.

BUDS AND LEAVES. In the normal preparation for the production of leaves and their axillary buds on ordinary stems, one, three, or more cords diverge at different points from the woody cylinder of the stem and enter the petiole, leaving gaps in the cylinder. (Figs. 88, 89.) If there be stipules, *their* cords always arise as branches from the most remote pair of cords which enter the petiole. (Fig. 90.)

The next cords in position to the middle one branch till they form

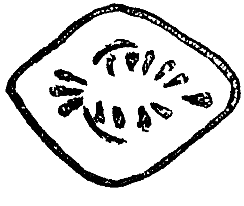


FIG. 89.—Transverse section of same, showing cords departing from the cylinder to enter a petiole on the left.

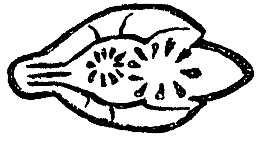


FIG. 90. Transverse section of same a base of petiole, showing branches entering the stipules, the cylinder of the axillary bud, and re-formed cylinder of the stem on the right.

more or less two semicircles. These close up and form a small cylinder in order to supply the axis of the axillary bud; while the other gaps in the cylinder also close up by bifurcation of the neighbouring cords.

* A specimen of *Senecio Jacobæa* had a fasciated stem, $\frac{1}{2}$ inch across (long diameter) at the base, and 1 inch at a point half a foot higher up; a branch of the same was $\frac{1}{8}$ inch across where it issued from the main stem, and $\frac{3}{8}$ inch at a distance of 1 inch above it. A Tulip peduncle, bearing four perfect and distinct flowers on long pedicels, was $\frac{5}{16}$ inch at the base, while the sum of the widths of the pedicels was $\frac{9}{16}$ inch.

As an illustration of an ordinary stem, let us take that of the Field Pea (*Lathyrus pratensis*). The stem is sub-quadrangular. (Fig. 88.) A section of an internode near a leaf shows three cords departing from the cylinder. (Fig. 89.) These enter the petiole, and the stipular branches are given off from the lateral petiolar cords, as shown in fig. 90. The two cylinders are now complete, the one on the left belongs to the axillary bud, that on the right is continued up the next internode.

Now, though a cord is given off to each leaf in the fasciated stem of the Cockscomb (figs. 85, 86), the "branch cylinders," as we may call them, required for axillary buds, are not, or rarely, formed; so that, as already mentioned, the cords all run parallel up the stem.

Axillary buds are often wanting in normal shoots; in that case only one or more cords pass into the leaf, none forming a supply for the axillary bud. The central cylinder at once closes up. This may be seen in a spring shoot of Lilac, which carries a number of pairs of leaf-blades as bud-scales. In none of these is any axillary bud formed at all.

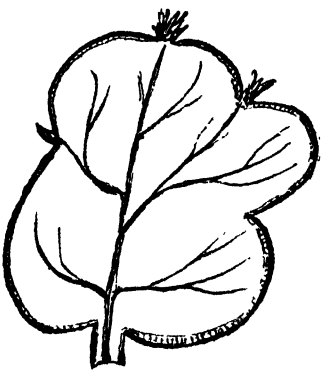


FIG. 91.—Vertical section of "multiform" Pear.

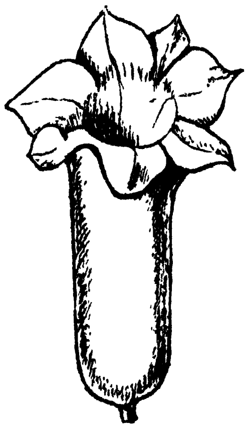


FIG. 92.—Regular corolla of Foxglove, with 7 petals, due to radial chorisis.

FASCIATED PEDUNCLES.—Though the main stem of a plant as well as the floral peduncles may be fasciated, one or other only may be so. Thus, in Cockscombs there is no fasciation at the base of the main stem, but much above, in the floral region. (*Cf.* fig. 84 with figs. 85 and 86.) Conversely, a fasciated peduncle of a Tulip gave rise to four separate flowers on non-fasciated pedicels.

As every floral pedicel is normally supplied with a small ring or definite number (say five) of cords, the multiplication of cauline cords which occurs in a fasciated peduncle provides, so to say, for many more flowers and bracts than would normally be borne by the non-fasciated peduncle.

The consequence is that a great increase often takes place in the number of *perfect* flowers and bracts. The Coxscomb and fasciated peduncles of Primroses, Cowslips, Hyacinths, &c., may be mentioned as frequently bearing such an increased number of ordinary flowers.

MULTIFOLD PEARS.—Another illustration of the result of branching

of the cords in the axis of a pedicel is seen in the tiers of abortive Pears sometimes formed one above another. In these there is no flower formed at all; but a central axial cord continually branches. The branches then give rise, so to say, to fresh swollen pear-like axes, for they are entirely composed of stem-structure. (Fig. 91.)

FLORAL FASCIATION, OR MULTIFOLD FLOWERS.—The next point to be considered is the production of a "multifold" flower, as I propose to call it, at the apex of a floral peduncle or pedicel.

The simplest case is when one or more of the whorls acquire an increase in the number of their parts. When the same number prevails in the whorls, it is a "symmetrical" increase. Such often occurs in flowers on a corymb of Elder-blossoms, which may range from fours to sixes, fives being the normal and commonest number. Such is presumably the result of a deficiency or superfluity of nourishment respectively, which the flower disposes of in the latter case by increasing the number of parts in the whorls. This is primarily effected by the cords becoming branched below.

Such symmetrical increase appears capable of being hereditary, as in Auriculas, for example.

A simple increase in the number of petals, coupled with a restoration to regularity, is seen in fig. 92 of a corolla of a Foxglove.

Far more complicated results may follow; and one can detect what may be distinguished as a multiplication by "radial chorisis," which determines an increase in the number of parts of a whorl, as in the Forget-me-not known as 'Victoria,' 'Jewell,' &c. (fig. 93), in which the petals are increased to various numbers from six to more than thirty, together with the stamens; and, on the other hand, there is often "tangential" chorisis, which gives rise to one or more aditional parts in front of one another on a radial line. In many multifold flowers there is a complete jumble of parts, giving the appearance of two or more flowers united, but in a higgledy-piggledy sort of manner.

Such a flower is usually described as synanthic; but I would carefully distinguish a truly *synanthic* flower, as described above in a Eucharis, from a *multifold* one. In the former there is usually a *loss* of some one or more parts, whereas in a multifold flower there is an *increase* in the number of parts. This results from the, say, normally five cords which supply a pentamerous flower bifurcating to such an extent that the calyx, corolla stamens, and carpels may all be abnormally increased in number, since each branch of the cord which would normally supply any one of the members can supply an extra one and more of the kind respectively.

M. Angel Gallardo, in a paper on the terminal monstrous flowers of Foxglove,* shows that it is perfectly hereditary to upwards of 50 per cent.

In some few cases it is associated with a fasciated stem, and always with vigorous conditions of growth. This implies that hypertrophy is the immediate inciting cause, which, coupled with the lessened vigour in the terminal growth of the stem, forces the production of a multifold flower instead of the elongation of the raceme of normal flowers.

He selected the number of stamens to scertain the degrees of

* *Revue Général de Botanique*, vol. xiii. p. 163.

frequency of the parts, and found that their maxima mostly ranged themselves about 8, 13, and 21. This clearly indicated a coincidence with the angular divergence of leaf arrangements—$\frac{3}{8}$, $\frac{5}{13}$, and $\frac{8}{21}$. But as the normal number of stamens is 4, the author also notes that 16 in one series gave a maximum.

Taking all his series of observations together, the following numbers formed maxima:—

4, 8, 13-14, 16, 20-21.

So that it appears that sometimes the normal number of stamens, 4, is multiplied, but in others the true spiral phyllotaxis is restored; for, of course, four stamens are merely due to the suppression of the posterior, or fifth, stamen of the whorl.

Figure 94 illustrates one of many forms of the "campanulate" flower which not infrequently terminates the stem of a Foxglove. It will be seen

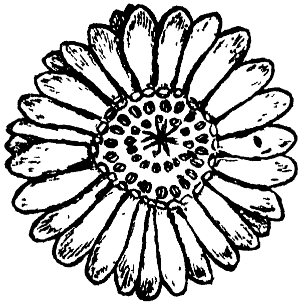


Fig. 93.—Multifold flower of the 'Victoria' Forget-me-not, showing numerous petals and stamens, from radial chorisis

Fig. 94.—Multifold flower of Foxglove resulting from tangential chorisis. (After Masters.)

that there are two or more irregularly formed corolla-tubes within the outermost; two or three sets of stamens have also been formed. The pistil of another flower, instead of having only two carpels, had eight, fig. 95 showing a section through the base of them. As another and more familiar instance, a garden Strawberry has often several sepals instead of five only.

Tangential chorisis is a familiar feature in Roses, Camellias, and some Daffodils, &c., in which the petals are piled up in radial series in front of one another.

Heredity of Multifold Flowers.—We all know that the fasciated form of the Cockscomb and some other plants is hereditary. If fasciation were merely the accidental grafting of several bud-shoots together, or only produced by accidental checking, &c., it is difficult to see how this hereditary feature could be established. If, however, we look upon it as

an *affection of the constitution*, however primarily induced, then it would not be difficult to realise the fact. Hence we have become familiar with multifold flowers and their resulting fruits in Tomatos and the Forget-me-not mentioned.

The late M. Vilmorin succeeded in fixing both a fasciated stem of Teazel and the large flower of the Foxglove described. He informed the writer that the proportion of seed which "came true" and produced the multifold flower with him was 90 per cent.

Although multifold flowers are often associated with a fasciated peduncle, it is not always so, for the Foxglove in question usually has the peduncle quite normal and not at all fasciated, the affection thus attacking the flower only. As it is at the apex of the flowering stem, where a superabundance of sap finds no outlet, Nature proceeds to multiply the parts of a single flower until it develops into a multifold one. The cause is hypertrophy.

That hypertrophied conditions of plants can become hereditary is familiar to all in the numerous garden vegetables, as Potatos, Cauliflowers, and all root crops.

Double Flowers. - These, also, receive their explanation from the

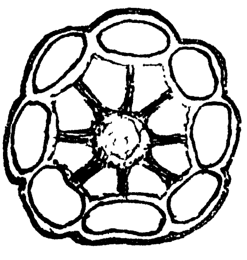


Fig. 95. Transverse section of ovaries of Foxglove, showing 8 carpels by radial chorisis.

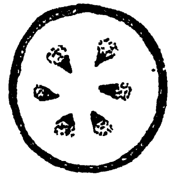


Fig. 96.—Transverse section of peduncle of double Snowdrop, below the swollen part.

same phenomenon of chorisis; for though the commencement of doubling is due to a substitution of petals for carpels and stamens, these become extraordinarily multiplied, and this increase is usually correlated with repeated branching of the cords within the floral receptacle. Each branch on reaching the surface continues on, but is now clothed in petaline tissue. Figs. 96, 97, 98 illustrate what takes place in a double Snowdrop. Below the swelling under the flower the stem contains six cords (fig. 96). There were no ovary cells in the case examined, but the swollen receptacle consisted of a solid axis of tissue with numerous branching cords (fig. 98) interspersed, all of which have arisen from the original six cords (fig. 96). These branches on reaching the surface supply a cord to every petal and sepal as the case may be.

Origin of Cords of Members in Normal Flowers.—When we speak of floral organs being homologous with leaves, it must be remembered, in connection with the subject before us, that the way in which cords are supplied to flowers is not altogether identical with that by which leaves receive theirs. I have already mentioned that one, three, or more cords travel outward from the stem-cylinder and enter the

petiole (figs. 88, 89, 90). This is usually also the case with sepals, but not always; so, too, is it the same with petals, but as a rule a definite number (five in Dicotyledons, and six in Monocotyledons) only enter the floral receptacle. Then, to supply all the parts, this is done by repeated branching. Thus, in an extreme case, at the base of the ovary in the

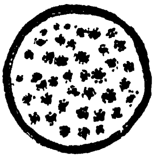


FIG. 97. Transverse section of swollen floral receptacle of same.

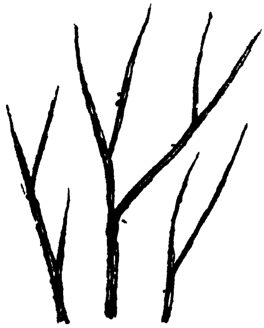


FIG. 98.—Branching cords within same, for supplying numerous sepals and petals.

Garden Marigold there are only two cords in the stem wherewith to supply the whole flower. One supplies two stamens and a carpel, the other, three stamens and a carpel. The petals have none in this flower.

Fig. 99 illustrates the distribution of the cords in a flower of *Jasione*, of *Campanulaceæ*. Five cords come up from below; when they reach the top of the ovary—which is inferior in this flower, as it is in the Canterbury Bell—they branch horizontally, making a complete girdle at the base of the floral whorls. The reader will understand how their parts are supplied by the accompanying letters, as follows: —Sepals (S), petals (P), stamens (St), style of the carpels (C).

In some flowers chorisis is repeatedly applied to a cord, and the result

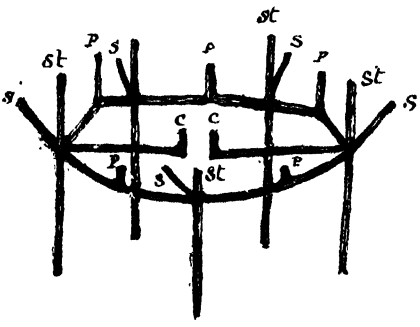


FIG. 99.—Isolated cords of the flower of *Jasione*, showing how members are supplied.

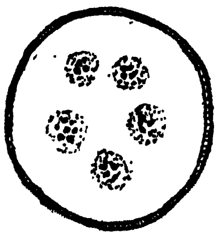


FIG. 100.—Transverse section of pedicel of Mallow.

is a multifold organ. This occurs, *e.g.*, in *Malvaceæ*. Thus, in Mallows five cords only enter the floral receptacle (fig. 100). Each divides tangentially into five, in two pairs, and one (outermost) being single. This last is for the petals (fig. 101, chorisis of *two* original cords only). The adjoining pair are for ten stamens; the innermost pair are for ten carpels.

Now each of the ten staminal cords branches again by tangential chorisis, producing three cords in a radial direction, each finally forming the cord of a distinct antheriferous branch (fig. 102); so that there are ultimately thirty anthers in a Mallow flower. In *Abutilon* there are sixty, in consequence of an additional radial chorisis.

A considerable amount of chorisis takes place in the flower of

FIG. 101.—Transverse section (two-fifths) of pedicel of same, showing increase of cords by tangential *and* radial chorisis.

FIG. 102. Three antheriferous cords by tangential chorisis.

Mignonette. The sepals receive three cords, one, central, direct from the axis, which commences with six large cords (fig. 103), and others as branches from intermediate cords, as shown in fig. 104. Much branching of the cords gives rise to the numerous stamens represented in the figure by the outer circle, and numerous cords form an inner circle. These are for the three carpels; but before entering that the cords combine and form six distinct cords.

These cases might be described as normal fasciation by chorisis, to supply multifold stamens and carpels. Many other cases might be men-

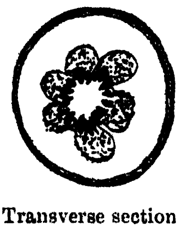


FIG. 103.—Transverse section of pedicel of Mignonette.

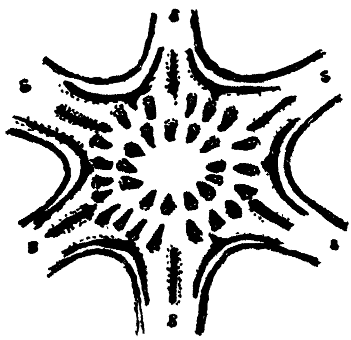


FIG. 104.—Transverse section of same passing through base of calyx (sepals, *s*).

tioned, as the stamens of St. John's Worts, and of the Castor-oil plant, Poplars, &c.

CRESTING.—This phenomenon comes under the same category, as it is correlated with chorisis of the cords within the foliaceous organ. When the organ, as a petal, has only a slight fringe on the margin, it is called "fimbriated," as occurs in some Camellias, Cyclamens, Odontoglossum,

Parrot Tulips, &c. This is associated with a continual bifurcation of the cords within the petals. They do not always actually reach the margin; but this grows out into irregular points, in sympathy, so to say, with the bifurcating cords below. A precisely similar process occurs in the style of Crocus, producing the "fimbriated" stigmas of that plant.

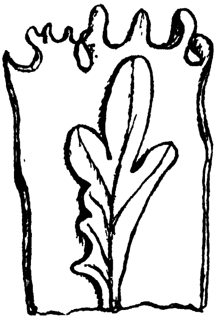


FIG. 105.—Portion of corona of Daffodil, with crest, and fimbriated margin.

FIG. 106.—Portion of corolla of Cyclamen, with crest.

A second form is seen in the cords sending out branches actually from the surface, when they are clothed with membrane; and a "crest" is formed, running down the line of the cord, either on the *outside* of the corolla, as sometimes occurs in Primroses and on the trumpet or corona of Daffodils (fig. 105); or *inside*, that is, the upper surface of the petal, in Cyclamen (fig. 106) and Begonia (fig. 107).

A similar phenomenon is seen in the sepals of the Crested Rose (fig. 108), and in leaves of Cabbages, as well as on those of the plant which

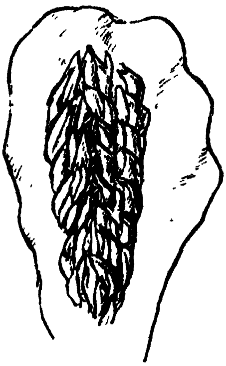


FIG. 107.—Petal of Begonia, with crest.

FIG. 108.—Rose with crested sepals.

bears "fimbriated" corollas in Cyclamen, known as *C. persicum fimbriatum.*

A Cabbage was figured in 1597 by Gerarde in his "Herball" (p. 248), and described as follows:—*Brassica prolifera*, the Double Colewort, "hath many great and large leaues, wherupon do grow heere and there other small iagged leaues, as it were made of ragged shreds and iagges set vpon

the smooth leafe, which giueth shewe of a plume or fanne of feathers." Three fragments of such Cabbage leaves are illustrated in fig. 109.

THEORETICAL ORIGIN OF OVULES.—The study of the crested Cabbage shows strong analogies, if they be not in strict homology with the origin

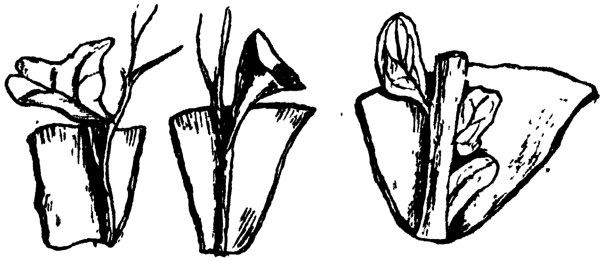


FIG. 109.—Portions of Cabbage leaves with foliaceous ribs, &c.

of ovules. They both originate primarily through hypertrophy; in the Cabbage, of course, abnormally; but it is normal in the enlarged margins of carpels called placentas.

A carpel, as of the Hellebore, is at first provided with a single cord from the pedicel (fig. 110). This divides into three (fig. 111); one forms the dorsal cord, or midrib, the other two are placental cords, which do not occur

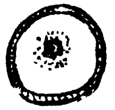


FIG. 110.—Transverse section of pedicel of carpel of Hellebore.

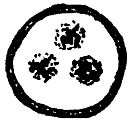


FIG. 111. Transverse section of same at base of carpel.

in ordinary leaves (fig. 111). These are associated with an enlargement of the margins by hypertrophy, in order to form the placentas which carry the ovules (fig. 113). Both of these cords then send off a small branch to each of the ovules.

In abnormal states of ovules they are not infrequently represented by leaves, cup-like structures or funnel-shaped outgrowths, apparently homologous with the ovular coat (fig. 114).

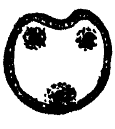


FIG. 112.—Transverse section of same, showing location of cords for midrib and placentas.

FIG. 113.—Transverse section of ovary of same.

This is well seen in the monstrous Mignonette described by the late Professor J. S. Henslow (fig. 114). On comparing the varieties of these malformed ovules, they can pretty well be all paralleled by the little foliar or funnel-shaped excrescences issuing from the ribs or veins of Cabbage leaves (fig. 109).

In both there is an external foliar expansion associated with chorisis of the cords of the ribs or veins induced by hypertrophy.

The homology, then, of a normal ovule appears to be complete with abnormal cresting or foliaceous outgrowths.*

Ovules, therefore, are not strictly speaking metamorphosed buds, as they have been sometimes spoken of; but really outgrowths from a fibro-

FIG. 114.—Malformed and foliaceous ovules of Mignonette.

vascular cord induced to grow out by hypertrophy of the foliar margins when forming the placentas.

CONCLUSION.—The object of the present Paper is to group together a number of different facts and so bring them under one common cause: though it is impossible at present to explain how the general term "hypertrophy" is connected with the branching of cords within, and the subsequent production of extra parts without, the plant.

* For further details the reader is referred to the writer's work—*Origin of Floral Structures*, p. 303.

BRITISH AND IRISH WILD PLANTS WORTHY OF CULTURE AND IMPROVEMENT.

By F. W. Burbidge, M.A., V.M.H.*

"Believe me, nature is much prettier as looked at in the garden or through a camera, than it is as seen along the barrel of a gun."

It seems peculiarly appropriate that we should consider the best, most useful and beautiful of our wild or native plants on the day of days that is sanctified by the very name St. George of England. The fact, however well known, cannot be too much emphasised, that some at least of our very best fruits, vegetables, and flowers are garden or cultivated developments of wild plants found in our woods and meadows or along the sea shore. It has been said that "charity begins at home," but the English people have never been quite satisfied with that proverb, and whilst often utilising to some extent the best of home productions, they have ever had a strong weakness for acquiring the best productions of other countries as well. The average Briton—"the man in the street"—is like Mr. Harold Skimpole: he wants but little in this weary world—"the best of everything" being good enough for him, and, moreover, he is not happy till he gets it.

Old Thomas Fuller told us that in 1600 we imported cherries, apples, and other fruits from the Continent, and "hardly had a mess of rath-ripe peas except from Holland, which," he drily adds, "were dainties for ladies—they came so far and cost so dear."

Even as late as 1776, when Adam Smith wrote his "Wealth of Nations," he took some trouble to point out what then was true, viz. that gardening was practised as an amusement by so many well-to-do people that market gardeners could make but small profits, since the rich "supplied themselves with all the most precious products of the garden." Nowadays we have changed all arguments under these heads, and many—even if not most—of our farm and garden products are brought to us "from afar," as Fuller has it, and they cost us actually less in our markets than the products grown at home. Adam Smith's argument has lost its force, since the increase of population and of industrial and commercial prosperity has created demands never even dreamed of a century or even half a century ago.

Thanks to cold storage, quick transit, and cheap freights, fruit and vegetables, and even flowers are welcomed and profitably brought to our shores from abroad, often at times when our own supplies are consumed or out of season, and still the finest produce of our own gardens also realises good prices when at its best.

I think it was Tennyson whose bugle note rang out sharp and clear in the beautiful charge to artists and all other men who do anything:—

"Take the thing that lieth nearest, make of that thy work of art,"

and so let us for the moment take the wild plants of our rocks and fells,

* This paper was to have been read on April 23, 1901; but, as a general emergency meeting of the R.H.S. was obliged to be held on that day, it was agreed to defer it until the publication of this number of the Society's Journal.—F. W. B.

and consider as shortly as may be how some of the best, most useful, and most beautiful may be cultivated, and, if possible, improved, in the garden. But we must also try to improve our country peasantry as well as the wild flowers.

Some far-seeing statesmen think it would be well to get the peasantry back to the land, but that is not easy after our national system of education and training has fitted them for work only in the towns. But if we make the country attractive to the children born there, and if we educate them especially for intensive farming or gardening pursuits, and do our best to show them the many and varied interests and advantages of a pure and healthy country life, then, and then only, will they consent to remain therein. I read of an instance of a lady,* a Mrs. Banger, of The Elms, Southwick, near Brighton, making £400 a year from a quarter acre of land and a little greenhouse, and that she is now spreading her wings further afield, and building a new residence from the proceeds of her industry. Now, if this be true, and in the main it must be so, this is an object-lesson worth the attention of the Sussex County Council and all who are interested in soil culture. We have free trade in everything almost except in land, and our land laws and customs need revising quite as much in England as in Ireland and elsewhere; cheap and simple means of purchase or security of tenure are especially essential. With land in the hands of the people who are able to make the best of it, we should have more good and pure food, and more healthy men and women to the acre; there might be less game, but Sir William Crookes's scarcity of wheat alarm need not frighten us, nor threatened invasion. We must educate the children who are born in and like the country to stay there, and do our best to win back some at least of the habits of old English thrift and housewifery. I am not sure that we shall breed sound and healthy children on "Swiss milk," or on any other stuff made in a factory and sent out in bottles or jars. True, you can purchase jams and jellies, pickles or preserves as cheap from the mere pecuniary point of view as you can make them after growing your own produce, but you never know what you are eating. A doctor of medicine has been defined as "a man who pours stuff out of bottles, of which he knows little, into human test-tubes of which he knows less." But we find that even the proprietors of the said test-tubes are careless, and rarely use the ordinary caution and intelligence of the forest monkeys as to what they are given to devour as food. We have just heard much of glucose in beer, and you can get lots of it also in cheap confectionery, sweets, and jam. A little schoolboy when asked in an examination—What is glucose? gave in the reply, "Glucose is made of anything on earth, and is put into everything we eat."

What with "substitutes" and "preservatives"—salicylic acid, for example—and "coloured" and "flavoured" or "sterilised" things, the wonder is that we do not suffer even more from stomach derangements and ill-health than we do.

In spite of improved education and County Councils, Food and Drug Acts, and other machinery supposed to protect us from wrong or deception, science is now employed by many manufacturers and advertisers

* *Home Chat*, March 30, 1901, p. 101.

as a stalking horse, under cover of which they can bamboozle innocent customers.

Wild Flowers.

> "Woods and groves are of thy dressing,
> Hill and dale doth boast thy blessing.'—Milton.

"Take all care of the beautiful," said the old Greeks, "because the good and the useful will care for themselves," so we cannot say or do too much in praise of, or in the care and protection of, our most beautiful wild flowers. We scour the forests, jungles and mountains, the pampas and the prairies of the whole world for garden or hot-house plants and flowers, or for vegetable products used in the arts or precious for "the healing of the nations," but we in a great measure neglect and undervalue the wild flowers and the field and forest products of our own land. All the *savans*, the great travellers male and female, Alfred Russel Wallace, or Miss Marianne North, tell us that no flowers on earth can rival the fresh spring flush, the summer lushness and sweetness, or the rich and ever varying autumn colouration of our native vegetation. Linnæus is said to have dropped on his knees in reverence at the golden gorse or furze as it first flashed on his eyes in England, and I shall never forget the ecstatic delight of a Swiss botanist as he first saw a wood of English blue hyacinths in Sussex, with wild rabbits hopping about amongst them! Ruskin tells us *he* never really felt the full force of what the words "purple and gold" meant to mortal eyes until he saw a field of purple-flowered clover, with a golden river of marsh buttercups running through its midst. The tropics are monotonous in their beauty, and for flowers that really colour and perfume the landscape for miles and miles we must look at home. Go where we may, there is nothing finer than gorse and broom, honeysuckle and hawthorn, followed by brambles, crabs, and wild roses, and the purple heather that paints whole mountain-sides with pure colour, and yields us honey and perfume at the same time. Our woods are sheltered arboreta, and are jewelled with anemone, hyacinth, foxglove, lily of the valley, and a host of other flowers, from the time the catkins of goat-willow and hazel or birch appear, until the brake fern turns brown umber and golden, and the leafy canopy of beech and chestnut and oak take on the livery of the dying year. We all know the flash of pure gold that comes from marsh buttercups in the green water meadows, the pink cuckoo flower or lady smocks "all silver white," oxeyed daisies, clover and fairy-like grasses and sedges of many kinds. Every hedge in England is a summer tangle of traveller's joy, wild roses and honeysuckle, every river bank and brook side or marsh is enriched with lythrum and willow herbs, or with golden-flag iris, and ostrich feathery plumes of meadow-sweet. What aquatic gardens there are along the river reaches or on the Norfolk Broads, the reed jungles, or willow-holts fringed with water lilies all afloat, with water buttercups, white and lacy-looking as a bridal veil. Everywhere in wild England to-day the sweet violet, the pale primrose, the sweet woodruff, and wood wind-flower make copse, wood, and hedgerow alike radiant and fragrant with vernal beauty. In the daisied meads the cinque-spotted cowslip hangs its

soft sweet head, and the daffodils or Lenten-lilies of England blow their golden trumpets as if to summon the swallow and nightingale to the climate Browning could not forget even when he was in sunny Italy.

Amongst the best of all our native wild flowers that have already been to some extent cultivated and improved we may name the wild roses, such as the sweetbriar, and the Scotch and Ayrshire roses. There is now a revival of rose growing and the rearing of seedlings in England, and the late Lord Penzance's new race of cross-bred sweetbriars may be taken as an object-lesson of the best. We have had no such distinct improvement in native or home-reared roses since the Scotch briars (*R. spinosissima*) and the climbing Ayrshire roses (*R. arvensis*) were reared nearly a century ago. We should like to see the results of hybridising *R. arvensis* or *R. rubiginosa* with the single-flowered *R. sulphurea*, a wild Persian kind, or of the Burnett rose (*R. spinosissima*) crossed with the dwarf and precocious blooming *R. multiflora*. But potentialities are legion when we consider the roses, and we may hope for actualities as well.

Violets, field poppy (Shirley), foxglove, lily of the valley, aquilegia, pinks and carnations, crocus, snowdrop, narcissus or daffodil, hawthorn, the daisy, *Viola tricolor* or pansy, primrose, and the wallflower and stock and wild rocket have also been improved, although much more is possible and remains to be done.

We have in our meadows and corn or turnip fields two wild chrysanthemums far finer than the wild species of China, Korea, or Japan, from which the garden chrysanthemums have been obtained. *C. leucanthemum* (white or oxeye) and *C. segetum* (corn marigold) are both worth selection and cultural improvement. No window plant, if we except perhaps the common musk, is so popular as is our native moneywort or "creeping Jenny," of which millions must be grown in pots and window-boxes in and around London alone. The evergreen Killarney saxifrage, or St. Patrick's cabbage (*S. umbrosum*), is naturalised abundantly in London gardens under the name of "London pride." Nothing on earth, not even from the tropics, can be more fresh and beautiful than many of our native or wild ferns, both evergreen and deciduous, and it is pleasant to know that they are now more popular than ever and more largely grown, while their names are being amended and the whole group better classified.

Wild Fruits.

"By their fruits ye shall know them."

Very few areas as small as are the British Islands are so rich in wild fruits, flowering shrubs, and timber trees. English oak made England a nation centuries ago, and even the acorns were formerly almost more valuable as "pannage" for swine feeding than the land on which they grew. Had not "Bluff King Hal" fostered and patronised the importation of Continental fruit trees into Kent, our British and Irish gardeners might have made even more than they did of our own apples or crabs, pears, plums, bullaces and sloes, two sorts of cherries, sweet and bitter fruited; raspberries, strawberries, gooseberries, currants, red, white and black; cranberries, and other ericaceous fruits, hazel nuts, and lastly, but

perhaps quite as important as any, the blackberry, tons of which are gathered every season by cottagers' and labourers' children in the country districts and sold at a profit in all our manufacturing towns. Blackberries, mushrooms, and in some districts wild bullaces and sloes, and watercress form the wild harvest or "jungle produce" for bright eyes and lissom fingers nearly all over the country, and but little, if any, harm is done in the gathering. Minor products are elderberries, medlars, crabs, and wild pears, springtops or autumnal trails of wild hops, coral-berried wreaths of tamus or black briony, our only British yam. The silvery fruits of clematis, or "Old Man's Bears," are also largely gathered and used for decorative purposes; so also the red-fruited water elder (*Viburnum Opulus*), mountain ash, and berberis berries for jellies, candying or pickling, as garniture for venison and other dishes. The jelly made from the rowan tree or mountain ash is indeed *the* thing for a haunch of venison, especially in the North, where both deer and rowan tree thrive so well. The little jet black crowberries, formerly esteemed of gourmands, and now beloved by the grouse on many a mountain side, are not much utilised to-day, but the wild cranberry and the Irish "fraughans" (*Vaccinium Myrtillus*) are gathered in quantities wherever they are plentiful and used in tarts or puddings. Even hips and haws have been used in rustic cookery, and old Gerard, in his celebrated Herbal (p. 1089), mentions preserved sweet-briar fruits as being excellent, "making pleasant meates and banketting dishes as tartes, and such like, the making whereof I commit to the cunning cooke and the teeth to eat them in the rich man's mouth." Of all our native or wild fruits the one worth earnest attention, culture, and improvement is the common blackberry or bramble. In the United States the culture of the blackberry as a market fruit is very extensive, and the economic results most important; but as a rule the best of the American kinds thrive but badly or intermittently in our own gardens. We may do much better by selecting, cultivating and improving from seed our native kinds.

Every stretch of blackberry country, every hedge, in fact, contains varieties of widely varying merit, and we must select the best flavoured, the largest fruited and most prolific kinds. It is a fruit that may be grown on rocky slopes or stony and poor ground quite unfit for most other uses. Selected wild varieties, and the cut-leaved variety (*Rubus fruticosus* var. *laciniatus*) are decidedly the best to start with, but by selection and cross-breeding under cultivation even finer, larger and more fertile varieties would, and could, be obtained. The wild bullace plums, so popular in Norfolk and the Eastern Counties, might also be much improved even under hedgerow culture. Some may ask me Why go to the trouble of cultivating that which already grows abundantly wild? Well, in the first place, we are rarely or never satisfied, especially by things that cost us little or nothing, and then there is that deep laid desire in every British heart to go "one better," in a word, to improve and ennoble whatever is taken in hand. Besides, there is in the British Isles to-day a gigantic army of gardeners, amateur and professional, and if every one of these is to have a hobby horse to ride, as every good and true gardener should have, well, then there is some chance for the selection, culture, and improvement of all the best of our native plants. No one cultivator can

take up or grow everything, but everyone may select and take up something and make it more beautiful or more useful for certain places or purposes than it was before. Hybrids have already been obtained between the blackberry and the raspberry, and attempts are in progress to ensure a happy marriage between the Japan wineberry (*Rubus phœnicolasius*) and the best of our native blackberries and raspberries. Even without actual garden cultivation much may be done by merely fostering the best of wild flowers, fruits, and vegetables in suitable places where they naturally grow.

Wild Vegetables, Salad and Pot-Herbs.

> "Great work is done be't here or there,
> And well man worketh everywhere;
> But work or rest, whate'er befall,
> The farmer he must feed us all." E. C. Leland.

It is curious how some of our most important native vegetables are found near the sea. Of these are cabbage, seakale, beet, celery, carrot, and asparagus. Horseradish and Smyrnium (Alexanders) also show a liking for the shore, as also "scurvy grass," which is an excellent salad when young as raised from seeds like mustard and cress. It was the great anti-scorbutic, and much sought after and eaten by sailors as a preventive or remedy for scurvy before the discovery of lime juice, the specific now so extensively and widely used. The wild radish is also a seashore plant, and its seeds, like those of rape charlock or turnip, yield excellent salading as quickly grown under glass. Chickory (endive), lettuce, dandelion (forced and blanched) and watercress are all well-known and excellent salads or vegetables raw or cooked. Asparagus, seakale, watercress, horseradish, and dandelion have been very little improved by cultivation, or by seminal selection, and experiments on each and all would be likely to yield valuable results. The same may be said of the meadow mushrooms (*Agaricus campestris* and *A. arvensis*), and there seems no reason why "virgin spawn," or spawn made direct from the spores, of fifteen or twenty other edible fungi should not be made and cultivated for food. The most delicious and valuable of all fungi, viz. the best edible kinds of truffles, certainly deserve more attention as to culture and discovery than they have yet received. The chances are that many tons of delicious truffles waste their sweetness in the young oak and beech woods and copses or on the downs of South England every year. One great difficulty is to find them, growing as they do underground. Both dogs and pigs have been trained to hunt and find them, and if the best French and Italian kinds could be introduced and grown in England, a not unimportant industry might be again revived. Many tons of the edible fungi of our woods and meadows are lost every year, mainly owing to vulgar prejudice and ignorance as to the difference between good and bad kinds. It is not generally known how easily the meadow mushroom may be grown in paddocks or meadows or in orchards near the house, by simply planting lumps of spawn in the grass in June or July; old cucumber, melon, or marrow beds "inoculated" with spawn in lumps the size of hens' eggs also prove very productive.

If children were taught by actual experience afield and in the kitchen

how delicious many of our common fungi really are they would be much more often gathered and used. One of the earliest to appear is the St. George's mushroom (*Agaricus gambosus*), so called because it often appears as early as on St. George's Day. It is the "mousceron," or "mousseron," of the French, the moss champignon, why so called no one knows, because it is a meadow or pasture growing species. From April until November, when the "blewits" appear, we have a constant succession of good and edible kinds—those interested may consult Cooke's "British Edible Fungi" for figures and other details.

The seaweeds of our coast lines have not had much attention given them since kelp-burning has been superseded by chemical products or by barilla. Algin is a product of some importance, useful for size, as a mordaunt in dyeing, and it is valuable for preventing the incrustation of boiler tubes, &c. Algic cellulose is also valuable, and can be bleached, turned and polished, or made into paper, and in combination with shellac forms a cheap non-conductor of electricity of great value. Algin, as combined with seaweed charcoal, is called "Carbon Cement," and is used in covering boilers and exposed steampipes, being one of the best of solid non-conductors of heat at present known. As food plants some seaweeds deserve attention. Green and pink laver may be eaten in soups, and dulse as boiled in milk is a noted Scotch delicacy, as is "sloke" in Ireland. Glue and jellies of various kinds are made from seaweed, as also an excellent substitute for isinglass. Carrageen, or Irish moss, has long been used as food, and as boiled for cattle feeding. It consists of *Chondrus crispus* and other species. It is well to know that the more tender of all seaweeds, like the young fronds and stipes of all ferns, may be boiled and eaten in all cases of emergency. We have no true moss of any value as an edible product, but bog moss, or sphagnum, and green wood moss, or hypnum, of various kinds, are very valuable to the growers of tropical orchids and of other greenhouse flowers.

Amongst salads, pot-herbs, and other useful plants the best of native origin are—mint (menthol), thyme (thymol), caraway, coriander, camomile, yarrow, lettuce, endive or chicory, dandelion, angelica, mustard and cress, burnet, horseradish, garden radishes, watercress, sorrel, scurvy grass, eryngium roots candied, samphire for pickling, fennel, dill, marjoram, savory, wormwood, elderflowers for toilet water, wine or vinegar, hop and nettle tops, Good King Henry (*Chenopodium Bonus Henricus*), leeks, Alexanders (now supplanted by celery), to say nothing of edible lichens, seaweeds, and fungi of many kinds to which we have already referred.

How to Select, Cultivate, and Improve the best of our Native Wildings.

"To study, culture and with artful toil
To meliorate and tame the stubborn soil;
To give dissimilar yet fruitful lands,
The grain, the herb, the plant that each demands;

. . . .

These, these are arts pursued without a crime,
That leave no stain upon the wings of Time."

The first thing is to feel a want, some ideal standard of excellence must be set up, to which it is thought any particular plant or product may be

wisely made to conform. The habit of the plant may be bettered, the size or shape or colour and flavour of its flowers or its fruits, roots, or leaves may be enhanced or improved; but whatever the earnest or long-felt want may be, will it so, stick to the point persistently, and ultimately in a great measure, even if not wholly, you will find the old adage verified that "all things come to those who will and wait." In all arts and crafts the first great motor power is the will, or the imagination, and this in the main is where the great artist differs from the merely clever and dexterous workman or maker of things inanimate on canvas or in wood and stone. But in improving the wild plants you are remodelling life itself; yours is a nobler duty than that of the artist, who simply imitates and ennobles inanimate, or even animate things. You are nearer to nature, and are really and truly carrying on the life work, the evolution of beautiful and useful created things. Having formed a clear idea as to the plant or plants best worth improving, the next point is to select the best wild varieties as breeders. Thus, in the case of the blackberry, you will choose forms remarkable for at least one good quality—it may be size, or flavour, or a good and prolific habit of growth and fruiting, and these may be further improved by cross-breeding the selected wild parents under good cultivation. Good culture does not always mean a deep, rich, heavily manured soil. The blackberry often does its best amongst rocks and furze bushes, or in hawthorn or sloe hedges, where its roots have to compete with others for earth food, but where they have shelter and support. Our failures with the best American kinds may be due to their having been grown alone in too rich earth in part, and also to the lack of bright sunshine, or of too much moisture. Then the blackberry is naturally a climber, and one that prefers a living support to a dead one. A hedge of bullace plums and blackberries might prove an ideal way on many dry warm soils. Both plums and other stone fruits like chalk or limestone soils, which also suit blackberries well, so that there is a double advantage in growing both together.

Plant improvement is effected by :—

1. Forming a strong and high ideal of what is beautiful or desirable.

2. Selection of the best or most suitable wild kinds and garden varieties.

3. By good culture of the finest of garden varieties.

4. By selection of the best garden-reared seedlings.

5. By careful cross-breeding the best wild and cultivated varieties.

6. By hybridising distinct species, or a distinct species and a garden or Continental wild variety together; and of course all these operations and phases of culture and improvement may be carried out side by side at the same time.

7. In the case of many good and distinct things like caltha, the greater buttercup, lily of the valley, asparagus, seakale, blackberry, &c., simply selection from seed or judicious cross-breeding would probably yield better results than hybridisation with other species.

In modern science, in politics, and even modern novels we often hear of what is called the "psychological moment," or the exact time for prompt action and all due appreciation. I am old enough to remember

when yellow blossoms as a class were scouted and rated vulgar—when daffodils were not valued as indoor flowers. The Maréchal Niel rose was one of the first of yellow flowers that became popular and started the "yellow fever" that culminated in the sunflower craze. Yellow daffodils always grew in our meadows and copses, and they had been grown in gardens in a tentative sort of way for two or three centuries before they became really popular and abundantly improved from seed. Sometimes, Shakespeare notwithstanding, a mere change of name leads to plants becoming popular. The Japanese Funkias never become universally grown and appreciated until a clever man called them "Plantain Lilies." It has been argued that the name is wrong, because Funkias have nothing to do with plantains, and that they are not true lilies; but in practice we often find that things "take" or "catch on" under euphonious names. Another case in point may here be cited, namely, the beautiful and variable race of yellow-anthered "Shirley Poppies," which were selections from the common black-anthered "field poppy" (*Papaver Rhœas*) made by the secretary of this Society some years ago. Selections from the same parent had been made before and grown in a half-hearted way in our gardens as the "French" or "carnation" poppy, but it lacked the advantages of time and place, there was no strong individual will with high ideals behind it, not even paternal love, let us say. Fortunately authors need no patronage to-day, but the plants, and especially new breeds or races and strains, are much the better for having earnest sponsors, real strong-minded and independent cultivators, who firmly believe in their beauty, in their utility, or at least in their sterling adaptability to certain uses and ends. So you see, apart from improvement, we must try to catch a propitious time, or we must wait until the right time comes for their "coming out." Above all, select short and pretty names for your seedlings, and make sure of a kindly godfather, and don't resent kindly and independent suggestions. I have only one more suggestion to make for this, I hope the time may be a propitious one—and I have done.

Conclusion.

"All's well that end's well." —Anon.

Just at present the air is full of good notions and ideas for more or less permanent memorials of a great and good Queen. We hear of books, pictures, statues, and memorial buildings of various kinds, but my own ideas of a great memorial to a great Queen and Empress would take the shape of a park or tract of rough country as extensive and varied as possible in soil and elevation, with ample wood and water supply, in and on which to cultivate and preserve for ever the best of our English trees, shrubs, and wild flowers. Such a plot or reservation might be formed in every county as a sanctuary for all beautiful wild things. Modern commercial, and industrial progress often means destruction and death to the haunts and lives of our wild beasts and birds, and especially of the flowers. If any wild animal is not in the game list, it has a bad time if either "Hodge" or "'Arry" own a gun. "If you see a rare bird, shoot it," is the maxim of ninety-nine out of a hundred of such "sportsmen."

We have, in name, an Act for the protection and preservation of wild birds at certain times, but its application is quite another matter, and you may see men and boys killing, and worse still mutilating, sea birds close to a coastguard station and within sight of the printed Act itself posted on the nearest gate.

We ought to secure an Act for the preservation or protection of wild flowers also, and agitate for its enforcement until it becomes something more than a dead letter. Not only are our country roadsides, hedges, and ditches robbed or poached of all the most beautiful of native plants, but even private woods and copses and meadows are also ruthlessly stripped by so-called "collectors" and sent off to wither and die in the towns. If you want to see a beautiful wild flower exterminated, name it in honour of some prominent politician. No, let us have our great county parks or reservations, and plant or sow our native wildings in honour of our best sovereigns and statesmen, instead of uprooting or sacrificing them. I want to emphasise the point that nothing whatever except native or British things is to be fostered in the suggested county reservations. The eagle on the rock, the heron in the pines, the badger in the gravelly wood, and the otter in the stream, if it may be, but at all costs let us have at least one garden park or wild park in England devoted to our native trees, shrubs, and wild flowers of all kinds. These things are preserved at Kew and in Epping Forest and elsewhere as far as possible, but up to the present time all effort in gardening has been mainly expended on crowding our parks and public gardens with exotic or "outlandish" things (as Parkinson says), so that but few ordinary people recognise what a wealth of form and colour and variety we really possess within our tiny shores. A noble garden or park is possible of attainment without the use of anything from other lands than our own. Fine turf, herbage of every kind, noble trees, both deciduous and evergreen, reeds and bright barked osiers, or soft grey willows, poplars and aspens, birch with bark like burnished silver and its drooping twigs glossy and dainty as a woman's hair, ferns and moss, lichen for the grey rock, water lilies, iris and great golden buttercups for the waters of marsh or mere—Scotch fir, yew, juniper, better than three-fourths of exotic Coniferæ, and everything perfectly hardy and happy in the open air. We have lately been asked to pity "the cooped, cabined and confined" animals and birds even in our best managed Zoological Gardens, and as a hardy and dauntless race we may now and then even pity the poor prisoners of the glasshouses or the "choice exotics" that linger and die in British gardens throughout the land.

Let us stop or stay the uprooting mania so far as we can and reverse the process. We may plant or sow primroses everywhere in honour of Beaconsfield, and we might also inaugurate a tree planting or arbour day in memory of Gladstone, but above all let us make sure of public parks, a circular belt around London, or county reservations for all our native animals and plants, and at least have one noble wild park or purely English garden near London named in honour of the late Queen and Empress Victoria.

GROWING ALPINE AND OTHER PLANTS ON WALLS.

By E. H. Jenkins, F.R.H.S.

[Read May 7, 1901.]

I do not for a moment say that wall gardening, or the growing of Alpine and other plants on garden walls, is novel, inasmuch as I have known something of it in its varying aspects for nearly thirty years; but it may safely be regarded as a rather exceptional phase of gardening, and certainly, in gardening pursuits, one of the most interesting. Then, if one would look at it from its utilitarian standpoint, it is obviously of considerable value in decorating and otherwise covering not a few of those mistakes that are continually cropping up in the garden, and more particularly in those instances where the all too straight lines and clean struck joints of the bricklayers are painfully evident. It is, moreover, worthy of remark in passing, that even in an ordinary brick wall it is a matter of surprise how large a number of really useful plants may be grown; the exact number having, perhaps, most to do with the subsequent care and attention bestowed on the subjects introduced.

To Mr. Latimer Clark.

But while on the very threshold of my subject, I cannot overlook the fact that I am largely indebted to the late Mr. Latimer Clark, then of Sydenham Hill, for a long and close apprenticeship to this very class of gardening. For many years Mr. Clark was a Fellow of our Society, ever closely interested in the Society's work, and especially interested in all that pertained to hardy things. The very hilly nature of his garden at Sydenham gave rise to a variety of retaining walls, more or less an obvious necessity in all cases, and, in a corresponding degree, all more or less ugly in a garden possessing so many good features naturally. It was, however, a chief desire and aim of his to hide and cover up the more conspicuous portions, and this, I think, was in time fairly well accomplished.

Mistakes and Errors Rectified.

Personally, as a matter of fact, I am considerably indebted to the above-named gentleman for the experiences gained in his garden; and, indeed, the failures and successes of that period have upon more than one occasion stood me in very good stead when engaged in this or similar work.

Difficulties to Contend with.

I have spoken of failures and successes, and without hesitation I say that many failures in the garden I have mentioned were obviously due to the construction of the walls, in which generally there was too much of the bricklayer's art. Of course the first and chief object of a retaining wall—should it exist for that purpose—is that it perform its function.

But it may still do this without being any eyesore, and, furthermore, with thought and judgment be so arranged as to be almost as well fitted to the growth of plants as an ordinary bed or border. This brings us face to face with one of the most important items in the case, *viz.*:

Walls and Suitable Walls.

Let us take the last part first and study "Suitable Walls."

1. This to my mind is a wall of sandstone or even freestone, and such a wall with its rugged surface is not only goodly to look upon, but far more helpful in receiving and retaining moisture for the plants.

2. Next to this I would place the clinkered burr wall, chiefly, however, for its ruggedness, though I greatly object to this material by reason of its hardness and non-porosity. At the same time, a wall of this material may be made among the most attractive, provided as always that due care be given to the selection of the subjects. This type of wall, too, is infinitely better for planting the subjects as the work proceeds.

3. Then there is the stone wall, *i.e.* the "dry wall," so abundant as fences in Gloucester, Worcester, and neighbouring counties. But for plant-growing the only variation necessary is some roadside mud or ordinary soil, and this filling up the interstices made by the roughness of the stones gives an admirable opportunity for the roots of many plants. In place of the soil mentioned thin layers of turf that have been long laid up may be mentioned as excellent, and where this valuable gardening commodity is in abundance I would say use it by all means. But while I have placed this particular type of wall somewhat low in the series of "Suitable Walls," I only do so advisedly, and because of the limit existing as regards the material employed. In the first-named county, for example, miles of dry stone walls may be seen formed almost wholly of the stone from the Ostrea and Gryphæa beds so abundant in the lower levels of the Cotswolds. In both instances the stone is a thin, flattish stratum of not more than three inches or four inches generally, and covered when fresh quarried with soft marl. The stone is also rendered picturesque owing to the abundant fossilised remains of the two geological groups named. The stone is even worth securing by those engaging in this particular phase of gardening, not only for its utility and picturesqueness, but equally for the quiet tone that years of exposure imparts to it. This I consider one of the most useful and serviceable of all, and, rightly constructed, valuable for plant growing, and ornamental withal.

Brick Walls.

4. Then there is the ordinary brick wall, built with soil in place of mortar joints, which has nothing to recommend it but dire necessity.

I do not say plants will not grow in such walls, because I know better. At the same time, such formal structures possess but little of the beautiful until the plants are well established.

A Necessity.

Where the brick wall is an absolute necessity, however, and assuming it occupies its position for retaining purposes, the actual retaining power

should exist apart from the brick face of the wall. And in this way. First arrange a hidden wall of concrete of 15 inches or 18 inches in thickness, well "battered," so as to be ready for any strain placed upon it. Such a provision may always safely terminate a little below the surface level.

In rendering the brick wall in front of this, good mortar is obviously no longer a necessity, but for its own safety it is better to render the first foot of brickwork in good mortar, carrying the remainder up in soil or soil and mortar joints to the required height. Usually in such a case the interstices between the bricks have contained the only available soil for the plants. With no further provision for the plants, it is often a matter of some difficulty in getting the plants established, and this can only be ultimately accomplished by keeping the wall constantly moist—in fact, dribbling the bricks day by day with moisture. Some years ago, however, I conceived the idea, when building up this brick face, of placing a thick plank between the front of the concrete and the outer bricks *forming* the face, the plank being drawn up as the work proceeded, and the intervening space thus made filled with soil into which the plants could root freely and at their own sweet will.

Advantages of this Space.

I do not think it will be necessary for me to enlarge upon the advantages of some such arrangement, and the soil being of a uniform nature in respect to dryness or wetness is in the main an agreeable one for plants to root into.

Raking Back.

There is, however, still one thing more that should be done in the case of the brick wall arrangement, and it is this: in building the brickwork, take care that the work be set back and not rendered to one plain facing line. This setting back is known as "*raking* back" to the brick-setter, and even though it be but ⅛ inch in each course of bricks, the ledges thus formed create excellent receivers and retainers of moisture for the plants either in times of wet or of watering, the plants receiving even greater benefits where the bricks are gradually sloped to the back, thus conducting the moisture to the roots of the plants naturally and most effectually also.

Walls of more Ornamental Character.

5. Then I would mention those walls intended more for ornament than use. Such as these, of course, can be arranged at will, but if plant-growing be thought of I would suggest the hollow-centred wall, with pockets in its summit and holes or side-pockets in the upper portions. In such a wall with the interior charged with soil, many of the more showy plants may be grown in a highly satisfactory manner.

Old Walls.

All these walls are capable of growing plants provided a little intelligent care and after-attention be thrown into the work. And provided this very essential part be not neglected it is not difficult to get plants established.

It is, however, quite another matter when one has to deal with walls that are two or three centuries old, for not only are such walls generally of exceeding dryness internally, but the mortar is almost cement-like in hardness. In such instances as these, however, it is always best to resort to seeds of known and tried kinds, and such things as Wallflowers, Snapdragons, Poppies, red Valerian, Kentucky Ivy, *Corydalis lutea*, *Zauschneria*, &c., may be planted with success, provided the moisture given is ample. This, however, is most important.

Position Helpful.

Position in such a case is, however, very helpful, and in such walls there are usually present some signs, as Moss, Lichen, &c., that will act as a sort of index to the interior and a guide to the planter. How much or how little may be done with these very old walls depends entirely on circumstances, yet when one finds such widely different subjects as Arbor-Vitæ, Dandelion, Yew tree, Red Sage, Scotch Fir, Gooseberry and Currant trees growing without care in very old and dry walls, the gardener need have but little fear if only he will try.

Districts and Stone.

I need hardly point out that where it is procurable stone is always to be preferred to brick. I hope I have not enlarged too much on the walls, for these are really a most important factor in the case. I will, however, conclude the wall portion of my subject by urging, whether the wall be of stone or brick, a certain provision of soil must be made, and this indeed is quite simple.

As to Planting.

We may now briefly consider the planting. Here I think it important to note in those instances where the planting can be done piecemeal, and particularly when the wall is of stone and plants of some size are being inserted, that it is well to *build and plant* as the work advances. Such work as the building is generally much better done by the interested gardener than by the most accomplished bricklayer, for the former does know that soil and space are essential to the growth of plants, and there is no need for clean-struck joints and the plumb-rule when in the garden proper. In this way, perhaps more than any other, are the plants supplied with soil direct. The same plan is likewise most helpful where the plants are either long or large rooted. For of course there are *walls and walls*, some rugged structures that would not be out of place if planted with Mulleins, &c., and others best suited to the more miniature of Alpines.

Seedlings.

Small seedlings, during cool and moist weather, may be inserted quite readily if the joints be raked out deeply so that the plant can be inserted without much risk. In all cases of planting into soil joints, where the walls are erected complete, I would suggest seedling plants without hesitation as a first choice, and *secondly* plants whose free rooting along the procumbent stems renders it possible and quite helpful to divide or pull into small pieces.

Early Experiences.

All my early experiences had to do with small bits of plants removed from the parent for the most part, or the surplus plants from the annual or biennial potting. This, unfortunately, has its drawbacks, and I remember one wall in particular that was well stocked contained in the main only small bits. This is naturally catalogued as among early mistakes in wall gardening, and is mentioned here for guidance. Much better results are secured by grouping, whether seeds or young plants or both are employed.

Plants in Groups.

For example, assuming the plants are forthcoming, a sample of grey wall may be secured by employing *Saxifraga longifolia*, *S. lingulata*, *S. Hostii*, *S. cochlearis*, *Achillea umbellata*, *Dianthus cæsius*, &c., &c. Another mass may be had from *Alyssum saxatile*, and fine pictures of colour by massing the Aubrietias, though always separately and not in mixed varieties. In shade or partial shade many of the crusted Saxifrages are very beautiful; while in the drier positions the Arachnoid section of House Leeks and the hardy Opuntias should be employed freely. Or, again, nothing could possibly surpass a rugged bit of wall devoted entirely to the following Saxifrages:—*S. longifolia*, *S. Cotyledon*, both of these having immense panicles of white blossom, while the June flowering *S. cochlearis*, with its mass of snow-white flowers, is perhaps the most satisfying of all. Then in the red Valerian, in Dryas, *Anchusa italica*, *Othonna cheirifolia*, we have plants worthy of being specialised in like manner. All that is needed to give effect to such things is suitable walls and suitable environment. This much conceded, the remainder resolves itself into the thought of the planter.

Old Walls—Seeds.

Very old walls and boundary walls—boundary walls particularly—I consider are infinitely better if treated with seeds, particularly so if, as sometimes happens, a moss-covered plinth exists, for this will be of material help when the seeds germinate. For these walls the commoner things are best—Wallflowers, Snapdragons, Poppies, Thrift, Aubrietias, and if a tall and showy plant be desired I know nothing that can in any way compare with the red Valerian. Two other plants deserving special mention are *Zauschneria californica* and *Corydalis capnoides aurea*. These are especially valuable, if not indeed *invaluable*, for quite dry walls. Both, however, should be sown in the walls, as plants fail again and again; while in freshly-built walls the former is much easier to establish if the stolons can be laid in as the wall is built. Indeed, numbers of plants may thus be established with comparative ease that are most difficult after.

Time for Planting.

As to time, I consider early autumn the best for a large number of seeds and plants, particularly where the former are long in vegetating. Plants may be inserted, too, in springtime, and of course success depends largely on the attention bestowed on the newly planted subjects.

Introducing the Seeds.

The seeds should be mixed with moistened soil, and soil of a slightly stiff nature by preference, for the light soils quickly crumble and give out when the least dry. More or less deep and long crevices should be made, so that the seed-charged soil may be safely inserted where desired. For example, if a display of Snapdragon was desired, a crevice of several feet long would be made on the face of the wall, and another a foot or more higher up, to thus create a group, and, of course, crowning the summit with the same thing, which should be of one colour only. Then the seed-charged soil may be inserted deeply enough for its safety, and finally faced up with a little plain soil. This is done as a precautionary measure, and though the seedlings may be a little longer in getting through, they certainly obtain a firmer footing in the end.

But whether it be seeds or plants, this much must ever be borne in mind, that the better the structure from the mason's point of view, the greater the difficulty for quickly establishing plants; and in the better class of walls and dry walls in particular nothing short of unceasing care and attention in keeping the surroundings moist is likely to bring a full measure of success. Finally, I would say plant freely and thickly, and regulate at a later period when growth appears.

The following are some plants that can be recommended for the purpose, but, as I have previously hinted, the number may be increased indefinitely according to the provision of the structure and the wish of the owner. Following the names in the subjoined list the letter "S" signifies that seeds are to be preferred, and "P" that plants are usually best. When both are seen it implies that seeds or plants may be used. In all cases, however, young plants, either seedlings or rooted cuttings, are best, and, of course, plants easily broken up with roots attached answer in a similar way :—

Alyssum saxatile	S.	Sedum and Sempervivum	P.
Aubrietia (any)	S.P.	Dianthus in variety	S.P.
Achilleas (dwarf)	P.	*Tunica Saxifraga*	S.P.
Thrift	S.P.	Alpine Phloxes	P.
Alpine Poppies	S.	Small Ferns, as	
Snapdragon	S.	*Ceterach officinarum*	P.
Wallflower	S.	*Asplenium ruta-muraria*	P.
Crusted Saxifrages	P.	" *trichomanes*	P.
Saponaria ocymoides	S.	Helianthemums	P.
Dryas octopetala	P.	*Euphorbia Myrsinites*	P.
Valeriana coccinea	S.	*Iberis* (Candytuft)	S.P.
Crucianella stylosa, var.	P.	*Campanula muralis*	P.
Zauschneria californica	S.P.	" *pumila*, vars.	P.
Corydalis capnoides lutea	S.	" *garganica* "	P.
Dwarf Columbines	S.	" *isophylla*	P.
Edelweiss	S.	" " *alba*	P.
Erinus	S.P.	" *fragilis*	P.
Thymus lanuginosus	P.	" *Tenorei*	P.
Arenaria	P.	" *Waldsteiniana*	P.

NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

In order to enlarge the usefulness of the Society's Journal we hope in future to give in each issue an abstract or short digest of all current Horticultural and Botanical periodical literature, British, Colonial, American, and Continental. A list of the Journals, &c., from which it is proposed to make abstracts is given below, together with the abbreviations used for the title of each. The list probably errs considerably on the side of omission, and we shall be grateful to anyone who will draw our attention to any publication of interest which should be included.

The work can only be done by a number of persons joining together for the purpose, each taking one or more of the Journals, Bulletins, or Reports, and making himself responsible for providing quarterly abstracts of them. Anyone with time at command and willing to help in this work should communicate with the editor, who is deeply grateful to those who have already offered assistance, whose names are given below.

In the course of making such abstracts as are intended, one will occasionally come across a really very important article, &c., deserving of a longer and more serious treatment. Such Notes we intend to place in a separate class under the heading of "Notes on Recent Research."

In a work undertaken by a number of persons, working quite independently and unable even to consult one another, some diversity of method will (certainly at first) be unavoidable, but it is hoped that as the workers see the produce of each other's labours they will intuitively recognise the better methods and in future conform themselves as much as possible thereto.

In this, the first issue, one thing only has been agreed upon, viz.: to

make the system on which we have worked as nearly as possible identical for the sake of the readers. It was therefore arranged to work thus :—

1. To place first the name of the plant, disease, pest, &c., being noticed.

2. The name (when it is given) of the author of the original article or note.

3. An abbreviated form of the name or title of the Journal, Bulletin, or Report in which the original article appears.

4. A reference to the number, date, and page of the Journal, Bulletin, or Report.

5. If an illustration of the plant, &c., is given to record it next, thus : "Fig. 1, 2, or 3," or "Tab. I., II.," &c.

6. After these preliminary necessities for making reference to the original possible, the short abstract or digest follows, ending with the initials of the contributor.

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JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt für Bacteriologie	Cent. f. Bact.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Die Gartenwelt	Die Gart.
Engler Botanische Jahrbücher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Hamburger Garten- und Blumenzeitung	Hamb. Gart. Blum.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. of Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R. A. S.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundsheitamte	Kais Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Notizblatt des Königl. Botanischen Gartens und Museums zu Berlin	Not. König. Bot. Berlin.
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gen. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.
U.S.A. Experimental Station Reports	U.S.A. Exp. Stat.
Wiener Illustrirte Garten-Zeitung	Wein. Ill. Gart.-Zeit.
Zeitschrift für Pflanzenkrankheiten	Zeit. f. Pflanz.

NOTES ON RECENT RESEARCH.

ALPINE PLANTS.

Plant Distribution in the Alps. By A. Engler. (*Not. König. Bot. Berlin*, Appendix. vii., Feb. 1901.)—An interesting paper on the plant communities of the Alps and the geographical distribution of Alpine species generally throughout the ranges.

The paper is noteworthy in several respects, but its primary purpose is to show how the Director of the new Berlin Botanical Gardens proposes to arrange the plants on the miniature mountains, valleys, swamps, and watercourses, so as to exhibit their natural habitats and assemblages.

As an instance, certain meadows in the Beech and Conifer regions of the lower Alps abound in such plants as *Carum Carui*, *Plantago lanceolata*, *Achillea Millefolium*, *Bellis perennis*, *Leontodon hastilis*, *Hypochæris radicata*, *Carlina acaulis*, *Thymus Chamædrys*, *Prunella vulgaris*, *Ranunculus acris*, and species of Rhinanthus, Euphrasia, &c. Among these occur *Genista sagittalis* and *Gentiana lutea* in the West of Switzerland. This particular type of meadow is dominated by two grasses, *Cynosurus cristatus* and *Agrostis vulgaris*, and it is evident that, apart from the Gentians and the Genista, such a plant community is by no means especially Alpine—we could match it in many English meadows. Engler terms this the *Kammgrass-weide* formation, which we might render Dog's-tail-meadow.

To take a very different example. There occurs at the upper limits of woody plants on the siliceous soils of the Central Alps and elsewhere, at great heights, a characteristic flora in which the Ling (*Calluna*) and the dwarf Juniper (*J. communis* var. *nana*) predominate, mingled with which various species of Vaccinium, of Lycopodium, and the so-called "Reindeer Moss" (*Cladonia rangiferina*) are conspicuous. Remains of a richer preceding vegetation exist in the form of such typically Alpine plants as *Anemone alpina*, *Campanula barbata*, *C. Scheuchzeri*, *Arnica montana*, *Hypochæris uniflora*, *Antennaria dioica*, &c., though these are more abundant in other communities of the higher Alps. This plant formation is termed by Engler that of the Dwarf Juniper and Ling—expressed in their German equivalents of course.

These two examples will serve to show what the author means by his Alpine plant formations, or plant communities as they are sometimes called, and plenty of other examples will occur to those who have read the œcological works of Warming, Schimper, and other recent authorities. Of such communities, occurring on various soils—wet or dry, calcareous, siliceous, or humus—at particular elevations and aspects, exposed on rocky, barren slopes, or sheltered in nooks and crannies, scorched by the summer sun, or in the perennial ice-water of the glacier streams, or at the edges of snow-fields, and so forth, Engler enumerates and describes in some detail no fewer than sixty-two. Nineteen of these are selected from the sub-Alpine and higher regions of the Northern calcareous

Alps, and include floral communities of river beds, heaths, moors, sub-Alpine meadows, rocks and forests, each characterised by certain predominating herbs, shrubs or trees, the presence of which gives the leading features to the formation, as seen from a distance, and implies the association of certain other species with these dominant ones. Eleven such formations are given for the woodlands and forests of the sub-Alpine and Alpine regions of the Northern calcareous Alps and Central Alps, while nineteen are chosen as typifying the meadow and pasture lands and grass-mats of these sub-Alpine and Alpine regions. The remaining thirteen are selected from the flora of the Southern calcareous Alps. Some of these include very long lists of species—*e.g.* the river-beds and banks and dry water-courses of the sub-Alpine regions, and the well-known typical Alpine meadows and moorlands; others—*e.g.* certain sedge formations, pine lands, &c.—comprise but few, in densely packed masses, giving special features, as of colour, for instance, to the landscape.

Engler's plan is to grow these plants in his new Botanical Gardens in their characteristic associations, so as to illustrate as far as is possible, in the climate of Berlin and in the space at command, the characters of such bits of the Alpine flora as nearly as can be done.

It is evident that we are here placed face to face with problems that will tax to the utmost all the art of the gardener, even as it does the science of the botanical geographer, and the wonder is perhaps less at the daring which proposes the scheme, and at the admissions of limits to the possibility of completely carrying it out, than at the energy and ingenuity displayed in the plan suggested for carrying into practice so heroic a bit of gardening enterprise.

The plan of the Alpine garden itself shows a series of hillocks and declivities, undulations and hollows, a water-course with islands and swamps, bits of rockery, forest and meadow-land and so forth, the various aspects, soils, &c., of which are to be utilised in regular order for growing, as we have seen, not merely Alpine plants, but characteristic groups of species to illustrate the points referred to. Thus, we find a certain area which looks on the chart like a "garden bed." On examining this in detail it is seen to have in it a patch of plants such as are found in the dry or half-dry river beds of the sub-Alpine regions—Alders, Hippophaë, Willows, &c., with herbs such as Thalictrum, Aquilegia, Asarum; Grasses such as *Hierochloë odorata*, Melica, Molinia; and Sedges such as *Carex glauca*, as well as a number of more curious plants. Of these certain Orchids and root parasites have to be excluded owing to cultural difficulties.

Another patch in this "bed" illustrates the Rock-Heath formation, in which *Erica carnea* predominates; while a series of Grasses—Sesleria, Calamagrostis; Orchids—*Epipactis rubiginosa*, Gymnadenia; and many interesting species of plants, such as Tofieldia, Anthericum, Biscutella, Polygala, Globularia, *Buphthalmum Bellidiastrum*, Daphne, &c., &c., go to make up the community.

On a knoll near this is a patch of sub-Alpine meadow, of the well-known type which blazes in summer with species of Anemone, Potentilla, Galium, Scabiosa, Arnica, Hypochæris, and numerous other Composites, Phyteuma, Gentiana, &c.; but again difficulties of cultivation exclude

Thesium, Rhinanthus, Botrychium, and a number of interesting saprophytes and root parasites.

Another knoll has a patch of moorland, with Carex, Rhynchospora, Cladium, Schœnus, Orchids and Grasses, and such forms as *Triglochin palustris*, *Allium suaveolens*, *Iris sibirica*, *Potentilla palustris*, *Primula farinosa* and *P. Auricula*, Gentians, Pinguiculas, &c. In the background is a patch of Beech-wood, with its characteristic undergrowth of Actæa, Aconitum, Prenanthes, Corydalis, Pyrola, Convallaria, Paris, Majanthemum, &c., &c.

Judging from the size of the "bed" referred to, it is clear that the selection of plants from the much longer lists than those here quoted will also be much limited by space, and once more we wonder how far the project can be carried out in practice. Something will no doubt be gained by the distribution in time as regards growing season and flowering period, but the scale of the chart—given as $\frac{1}{600}$—suggests very serious crowding. Of course, such plants are crowded in their natural habitats, but we are here thinking of the difficulties of cultural operations entailed by weeding, planting, &c., as well as of the limitation of effect if species like many of those mentioned are not massed in large patches. Jumping from one floral patch to another may also be very detrimental to the effect from a gardening point of view.

It will be interesting to learn what will be the effect of and how far the following groups of plants can be represented and kept up. It forms the community of the snow valleys and drifts and glacier margins, and includes *Salix serpyllifolia*, interspersed with *Gnaphalium supinum* or *G. Hoppeanum*, and *Soldanella alpina* and *S. pusilla*, *Poa minor*, *Carex atrata*, *Sagina Linnæi*, *Alsine Gerardi*, *Ranunculus alpestris*, *Anemone narcissiflora*, *Thlaspi alpinum*, *Hutchinsia alpina*, *Arabis alpina* and *A. pumila*, *Cardamine alpina*, *Saxifraga stellaris* and *S. androsacea*. In this mass, predominantly white, come *Viola biflora*, *Epilobium anagallidifolium* and *E. alsinifolium*, *Meum Mutellina*, *Gentiana nivalis* and *G. bavarica*, *Veronica aphylla* and *V. alpina*, *Pedicularis verticillata*, *Pinguicula alba*, *Erigeron uniflorus*, *Achillea atrata*, *Chrysanthemum alpinum*, *Aronicum Clusii*, *Crepis aurea*, *Leontodon Taraxacum* and *L. pyrenaicus*, all of which are chalk-loving plants. The formation also includes the following chalk-fleeing types: *Salix herbacea*, *Alchemilla pentaphylla*, *Sibbaldia procumbens* and *Arenaria biflora*.

This brings us to the glacier clay flora, in which *Polytrichum septentrionale* plays a leading rôle, but which it is not proposed to have represented in the garden.

Of course many of the above plants can be cultivated; but the point here is, how far can they be kept together in their characteristic associations, and yet flourish in a climate so different from their native Alps? Clearly they cannot be left to merely fight it out, and strike the balance, as they do in their natural struggle for existence, and one is appalled to think of the work entailed in keeping the encroaching Grasses, Epilobium, &c., in order, and nursing the sensitive Saxifrages, Gentians, &c.

What will be the effect from a gardener's point of view, and how far it will be worth attaining from the botanist's point of view, are other questions; personally, we have been disappointed in viewing previous

efforts to provide Alpine plants with imitation Alpine surroundings. We fully recognise that Dr. Engler has wider schemes in view than this, however, and shall await the results with great interest. It would carry us too far to analyse the rest of Engler's paper in detail, and it must suffice to say that he gives a summary of the way the plant communities, above referred to are distributed in the various districts of the different Alpine regions—in other words, a sketch of the geographical distribution of Alpine plants—as well as a short account of the geological history of the flora of the Alps, and a brief synopsis of the chief methods and facts of plant dissemination in general.

This cursory glimpse at a paper bristling with details of interest and importance to all horticulturists does scant justice to its merits in other directions. It is undoubtedly a useful contribution to the literature of the Alpine flora, full of suggestion, and, as we have shown, outlining a bold and comprehensive piece of gardening, to which we may well wish every success in the interest of experimental botany. No doubt exception can be taken to some of the terminology and spelling, *e.g. Asplenum*, *Aera*, *Brunella*, and *Sesleria cærulea*, *Alectorolophus* (*Rhinanthus*) and *Abies alba* for Silver Fir, which is not always consistent, moreover; and there may be divisions of opinion as to the selections of the plant communities in various cases; but these details do not seriously detract from the value of Engler's work as a comprehensive and suggestive essay on a new and interesting topic of the utmost importance. One omission, if rectified in any further edition, would enhance the value of even so valuable a paper. There is no list of the literature, and we should like to see references to the collections and writings of such pioneers in Alpine floral work as John Ball, Packe, and others.

A later number of the same publication* contains articles on a Scale-insect disease of Cocoanut Palms in the Carolines, to combat which Volkens proposes the introduction of Coccinellideæ, or Ladybirds; on an injurious Orchid fungus, *Nectria bulbicola*, by Hennings; several notes on recent systematic work, *e.g.* Schumann on *Grewia asiatica* in Africa, and on some new species of Mapania; Mez on two new species of Embelia from China. Neither these nor the notes on the collection of Mangrove bark, &c., are of sufficient horticultural importance for further treatment here. *M. W.*

Agriculture and Forestry.

Agriculture and Forestry.—Those interested in the progress of agriculture and forestry will find useful and valuable material in the papers published by the Biological Division for Agriculture and Forestry of the *Kaiserliche Gesundsheitamte*, Berlin. This division of a large governmental research station was founded about the beginning of 1899, and staffed by well-known workers from all parts of the German Empire. The results of their work are now appearing. The papers are issued as "Heften" of various sizes, which may be purchased in series or singly. That they are published by the well-known firms Paul Parey and Julius

* *Notizbl. des königl. bot. Gart. und Mus.* B. III. No. 25, May 1901.

Springer, of Berlin, is warranty of the workmanship. We give the titles of the more important papers, which will indicate the scope of the work; later we hope to review these in detail as they appear:—

Bd. 1, ht. 1, 1900 (5 marks): Rörig—"Investigations on the Contents of Stomachs of Birds important in Agriculture and Forestry." Frank—(1) "The Bean-Weevil," with illustrations; (2) "The Influence on Enemies of the Wheat Crop of Time of Sowing, and of Manuring with Nitrate of Soda."

Bd. i. ht. 2, 1900 (7 marks): Frank—"The Combating of Weeds by Solutions of Metallic Salts," with plates. Hiltner—"Root Tubercles of Leguminosæ." Jacobi—"The Eating of Stones by Birds."

There are also several short papers on various subjects:—

Bd. ii. ht. 1, 1900 (10 marks): Rörig—"The Crows and Rooks of Germany in relation to Agriculture and Forestry." C. von Tubeuf—(1) "Leaf-cast of the Pine," with plates; (2) Short papers: (*a*) "Methods of Carrying on Infections on the Experimental Fields of the Department;" (*b*) "Experimental Infections with *Æcidium Strobilinum*, parasitic on Cones of Spruce" [this paper proves the connection of this with a Puccinia on Bird Cherry]; (*c*) "*Fusoma parasiticum*, a parasite on Seedling Conifers;" (*d*) "*Tuberculina maxima*, a Fungus parasitic on Blister-rust of the Weymouth Pine;" (*e*) "Experimental Infections with *Peridermium Strobi*, the Rust of Weymouth Pine" [prove species of Ribes as hosts]; (*f*) "Observations on Distribution of Parasitic Fungi by Wind;" (*g*) "Experimental Infections with Gymnosporangium on common Juniper and Mountain Ash." *W. G. S.*

Catalase, a new Enzyme.

Catalase, a new Enzyme. (*U.S. Dep. Agri. Rep.* 68.)—Oscar Loew gives a very full account of the ferment, or enzyme, discovered by himself, first in the Tobacco plant, and subsequently proved to exist in a whole series of seeds, leaves, and other parts of plants. According to the author, "there does not exist a group of organisms, or any organ, or even a single vegetable or animal cell that does not contain some catalase, so far as his observations go." It is called by him catalase, and has the effect of decomposing hydrogen peroxide. This substance is of a highly poisonous character, and it is suggested that hydrogen peroxide is formed in the process of respiration, and at once removed by the catalase existing in the cell. A very full account of the reactions and general behaviour of both α and β Catalase is given in the paper, to which reference must be made by all interested in the question of enzymes and fermentations.

G. F. S.-E.

Club-root Experiments.

Club-root is a well-known and widely-distributed disease that specially attacks Cruciferous plants, and is caused by a Myxomycete or slime-fungus known to science as *Plasmodiophora brassicæ*, Woronin. Its direct attack is invariably confined to the roots, which under the excite-

ment of the parasite grow to an abnormal size and shape, and then gradually pass into a state of complete rottenness, rendering their incorporation with the soil a comparatively easy process. But as each putrid root contains countless numbers of the exceedingly minute resting spores of the disease-producing fungus, the soil bearing a diseased crop soon gets thoroughly infected, rendering it for the time being entirely unfit for the growth of that or any other Cruciferous crop.

Numerous experiments, both in this country and abroad, have been tried in order to discover a sure method of prevention of this fatal plant disease, the most recent being those recorded by the Staff Botanist of the New Jersey Agricultural College,* who has been experimenting with club-root for the last six years.

Of course all efforts after prevention must be directed towards the soil, as that is the source of all infection to seedling plants. In these series of experiments a considerable number of antiseptic substances were applied in varying proportions to the soil, but, as already discovered by other experimentalists, air-slaked lime is the only certain remedy. The amount used per acre varied from thirty-five to fifty bushels. The experiments also show that time must be given for the quicklime to act, as, if applied to the land in spring just before seeding, less benefit arises than is secured by incorporating it with the soil in autumn. Similar results have been arrived at in this country by Sommerville and others. Kainit had no effect, while copper sulphate injured the crop without harming the parasite in the very least. Corrosive-sublimate seemed to have some value if used in solution, but proved injurious to the crop when the strength passed a certain standard. Common salt, even at the rate of 600 lbs. per acre, had no effect upon either crop or club-root. Strangely enough sulphur, applied at the rate of 300 lbs. to 1,200 lbs. per acre, actually increased the percentage of clubbing. Carbonate of lime, at the rate of 3,000 lbs. an acre, seemed to produce good results in a year's time, but was not nearly so effective as the burnt lime.

It was observed that irrigation in an infected field greatly increased the virulence of the disease. It may be presumed that the abundance of moisture gave greater facilities for the locomotion of the motile "spores" of the slime-fungus, and so helped to spread the infection.

A very interesting experiment, although on a small scale, was with Buckwheat in relation to clubbing in Turnips. This plant was sown in an infected plot, and the crop allowed to reach the seeding period. The stems were then chopped up and dug into the soil, and a crop of Turnips sown on the land. A distinct reduction in the percentage of diseased roots was noticed, and even better results were secured the following year; but after that, the effect of the Buckwheat rapidly ceased, and the soil got "turnip-sick" again.

It is well known that, so far as present experience goes, no plants outside the Cabbage or Cruciferous family are attacked by this particular kind of disease, and even among Cruciferous plants there are gradations in susceptibility to the attack. The following list is compiled from the

* "Twentieth Annual Report of the New Jersey State Agricultural Experiment Station," and the "Twelfth Annual Report of the New Jersey Agricultural College Experiment Station for the year 1899."

Report under notice, the plants being arranged in proper order of relative susceptibility :—

1. Charlock (*Brassica Sinapistrum*, Boiss.).
2. White Mustard (*Sinapis alba*, L.).
3. Rockcress (*Arabis lævigata*, Muhl.).
4. Shepherd's-purse (*Capsella Bursa-pastoris*, L.).
5. Black Mustard (*Brassica nigra*, L.).
6. *Camelina sativa*, L.
7. Candytuft (*Iberis umbellata*, L.).
8. Sweet Alyssum (*Alyssum maritimum*, L.).
9. Radish (*Raphanus sativus*, L.).
10. Rocket (*Hesperis matronalis*, L.).
11. Stock (*Matthiola annua*, Sw.).

The last on the list was not attacked at all, although, like the rest, it was grown on infected soil. In addition to Stock, the following Cruciferous plants were found to withstand clubbing in infected plots : *Lunaria biennis*, L., Watercress, Curled-cress ; several kinds of garden Radish ; *Arabis canadensis*, L., and *Arabis glabra*, L.

The present series of experiments also confirms the results obtained in this country--namely, that the spores of the fungus can remain a long time inactive in the soil. Further, that healthy soil can be easily infected with diseased roots applied directly to the soil, or as manure from stock fed upon diseased roots, as the fungus, in its spore condition, can evidently resist the digestive processes that arise in the alimentary tract of a herbivorous animal. *D. H.*

Ferments in Fungi.

Ferments in Fungi which attack Trees. (*Bei. Bot. Cent.* bd. 10, ht. 2, p. 90). Herr Kohnstamm has investigated the Enzymes or ferments present in the dry-rot fungus *Merulius lachrymans* and *Agaricus melleus*, &c. The fungus tissues were ground in quartzsand and kieselguhr, and the fungus sap extracted by pressure. The liquid thus extracted was tested with starch, &c., and the presence or absence of the enzymes recorded. A diastase like that of malt was found in *Agaricus melleus*, *Merulius*, and *Polyporus squamosus*. A ferment similar to emulsin, and attacking glucosides, was discovered in *Merulius* and *Polyporus* but not in *A. melleus*. A ferment attacking proteids (proteolytic) was also discovered in all three of these fungi, though it was somewhat feeble in the last-named. Cellulose-destroying enzyme was also found in *Merulius*. These ferments are necessary to the growth of the fungus. The amylase destroys the starch in the woods attacked by the fungus ; the " emulsin " disintegrates the coniferin of Coniferæ, and the æsculin of the Horse Chestnut ; whilst the proteolytic ferment works upon the protoplasm of the wood parenchyma and any albuminoid substances present in the cells. All these bodies are thus changed into solutions capable of nourishing the fungus. *G. F. S.-E.*

Effects of Various Salts.

Effects of Solutions of various Salts on Weeds and Cultivated Plants. By B. Steglich. (*Zeit. f. Pflanz.* bd. xi. ht. 1, p. 31;

March 14, 1901.)—A contribution on combating weeds by spraying with solutions of various salts. The following table gives results for sulphate of iron, nitrate of soda, and sulphate of ammonia. In the original paper details are also given for chloride of potash and chloride of magnesium in 30 p.c. and 15 p.c. solutions, and for other plants (Beet, Beans, Lupine, Flax, and Equisetum). The various solutions were applied at the same rate, 35½ gallons per acre. In the case of Wheat, Barley, Oats, and Rye the plants were more or less injured by all the solutions, but recovered in five to eight days :—

	Iron Sulphate	Nitrate of Soda		Sulphate of Ammonia	
	20 p.c.	30 p.c.	15 p.c.	30 p.c.	15 p.c.
Potatos	much damaged	killed	killed	killed	killed
Peas	damaged	,,	undamaged	,,	slightly damaged
Vetches	,,	,,	,,	,,	,,
Clover, Old	,,	slightly damaged	,,	slightly damaged	undamaged
,, Young . . .	much damaged	,,	slightly damaged	,,	,,
Charlock (Brassica) / Runch (Raphanus) .	killed	killed	killed	killed	killed
Thistle (Carduus spp.) .	damaged	much damaged	much damaged	much damaged	much damaged
Sowthistles (Sonchus spp.)	slightly damaged	undamaged	undamaged	,,	slightly damaged
Sorrels (Rumex spp.) .	-	,,	slightly damaged	,,	,,
Redshank (Persicaria) .	-	killed	undamaged	,,	undamaged
Knotgrass	-	undamaged	,,	undamaged	,,

Thistles, Sowthistles, Sorrels, and Docks, which were not completely killed by the spraying, suffered only temporarily and recovered.—*W. G. S.*

FROSTS AND FRUIT.

Spring Frosts and Fruit Trees. By H. Müller-Thurgau (*Zeit. f. Pflanz.* bd. x. ht. 6, p. 335; figs. 1, 2, 3; January 1901).—During March 1900 the temperature near Zürich, Switzerland, fell suddenly from mild to sharp frost at night. The author had the opportunity of seeing much of the damage which followed. Discoloured twigs and buds, and the usual signs of damage by spring frost, were soon reported, but the paper deals especially with injury to the flower-buds, which only becomes evident when the crop of fruit fails. The injury to flowers of Cherry presents an interesting series, from death of the whole bud to that of parts only. The many specimens examined belonged to one of the following groups: (*a*) Many of the flower-buds unfolded and produced no flowers, the enclosing leaves were healthy but the flower parts were found dead at the stage of development corresponding to the date of the frost; (*b*) other buds had the enclosing leaves and the calyx unharmed, the remaining

parts dead; (c) buds opened and showed flower, but the reproductive organs—stamens and pistil—were dead in an embryonic condition; (d) buds developed normally except the pistil, which was either entirely dead or parts of it—*e.g.* the ovules—had been killed. In such cases the production of fruit was impossible. It is interesting to note how the outer parts resisted the frost, which penetrated and killed the inner reproductive portion of the flower. Similar effects of frost are found on Apricot, Peach, and Strawberry. In the latter crop it is not uncommon to have a perfect show of flower, yet the fruit remains hard and useless. These effects of late frosts are doubtless responsible for damage which is put down to the action of other agents. For instance, Prof. Thurgau has shown in this and previous papers that epidemics of the fruit-rot (Monilia) on various fruit trees are primarily due to injuries by frost, which prepare the way for the fungus. In the case of Apple and Pear, the author describes how spring frosts may cause a brown discolouration of the pith in or immediately below the buds, without leaving any evidence of damage to parts outside the pith. As the buds develop the injury to the pith becomes more or less evident, and in the case of flower-buds the reproductive parts suffer first. A case is figured where the flower has been complete except the ovary and ovules, which remained dead in the condition they were at the time of March frost; the fruit developed apparently in the usual way, but it contained no seeds, and in shape was less rounded than healthy fruits.—*W. G. S.*

Fungoid Disease.

Fungoid Disease, a New. F. C. Stewart, Botanist at the New York Agricultural Station, Geneva, describes and figures (*Bull.* 179) a fungus new to science that attacks the cultivated Snapdragon (*Antirrhinum majus*, L.), causing the formation of elliptical or circular sunken spots on the skin and leaves of the plant. The disease is called anthracnose, and the fungus has been named *Colletotrichum antirrhini*. Experimental plants grown in a house side by side with badly diseased specimens were kept free from the disease by spraying once a week with Bordeaux Mixture. It is recommended to give plants subject to this disease and grown indoors plenty of air, and to keep the foliage as dry as possible. In the case of propagation by cuttings, it is further recommended to select cuttings from healthy plants only, as the disease may be transmitted to new generations by means of already infected shoots. It is improbable, however, that the disease can be transmitted by seeds.

D. H.

Glucosides and Fungi.

Glucosides and Fungi (*Bei. Bot. Cent.* abt. ii. bd. 10, ht. 1, pp. 1–50).—Herr Andre Brunstein gives a detailed account, with sixteen tables, of the action of fourteen fungi, chiefly Aspergillus spp. and Mucor on selected glucosides. He finds as a general result that fungi are able to decompose helicin, salicin, amygdalin, and especially coniferin solutions, and that these bodies break up into glucoses and benzol derivatives. The glucose is then utilised by the fungus, but the benzol derivatives were

apparently not broken up by its action, though these were often oxidised by secretions of the fungus mycelium outside the cell. Arbutin solution was exceptional, for although it was broken up by the action of the mycelium into sugar and hydrochinon, this latter product appeared to destroy the fungus. Helicin was not of much value for nutrition, as the salicylic aldehyde formed in its decomposition became oxidised to salicylic acid, and this had a poisonous action on the mycelium. Salicin, coniferin, saponin, and glycyrrhizin gave similar results. The nutritive value of these bodies, as regards the fungi, is shown by the quantitative analysis of the dry mycelium of *Aspergillus Wentii* after five days' growth on the following substances :—

Normal weight on distilled water . .	1·00
On arbutin solution	0·95
On helicin	1·60
On salicin	2·00
On amygdalin	2·90
On myronic acid, potash solution . .	2·90
On coniferin solution	3·20
On Raulin's nutritive solution . . .	6·00

The age, previous nourishment, and inherited peculiarities of the mycelium of the same species of fungus may produce quite different results when the fungus is brought into such solutions.—*G. F. S.-E.*

Leaves, Transparency of.

Leaves, Transparency of (*Bei. Bot. Cent.* bd. 10, ht. 2).—Dr. L. Linsbauer has measured the amount of light passing through the leaves of a great number of plants by means of Wiesner's photometric method. The sun leaves and shade leaves of the same plant show great differences. Generally the shade leaves are much more transparent than those which are exposed to the sun. The transparency was least in the cases of the sun leaves of *Cornus sanguinea* and *Cytisus Laburnum*, whilst the shadow leaf of the Beech allowed more light to pass through than any of those examined. Perhaps the most valuable part of the paper deals with the effect of hairs, a red colouring of anthocyan, and the chlorophyll itself in diminishing the light passing through a leaf. Thus colourless parts of a leaf will allow on an average 0·320 part of the light to pass through, whilst if chlorophyll is present in the same leaves only 0·056 passes. The tissues absorb 68 per cent., and the chlorophyll 26·4 per cent. of the light. These results were obtained by testing colourless and green parts of variegated leaves. The protections against too strong an insolation are summed up as follows :—

1. The angle of the leaf to the light which falls on it.

2. The natural habitat of the plant, *e.g.* in the shade of a wood. The author records a light intensity inside a Beech wood as 0·0111, whilst at the same time it was 0·333 outside the wood.

3. Hairs greatly diminish the light passing through. The hairs were removed from one-half of a young leaf, and the amount of light which passed through this half was 0·027, as compared with 0·014 passing through the uninjured half.

4. A deposit of wax on the surface diminishes the light passing by 0·9 per cent.

5. The red colouring matter anthocyan diminished the amount of light passing through leaves of *Cornus sanguinea*. In ordinary green leaves this was 0·0004, and in the red anthocyan leaf only 0·0001. Young leaves are generally more transparent than the mature form, but this is not always the case, *e.g.* a young leaf of Coltsfoot only allowed 0·0007, whilst the mature leaf permitted 0·009 of the light to pass through. The method is fully detailed and is no doubt satisfactory, but some of the results in the tables given on page 65 are very unexpected.—*G. F. S.-E.*

Manuring Potatos.

Potatos, Recent Experiments on the Manuring of. By R. Patrick Wright (*Jour. Bd. Agri.* vol. vii. No. 4, pp. 438-454; March 1901).—An important paper giving the results of a considerable number of experiments in the manuring of Potatos which were carried out at the collegiate centres of agricultural instruction in Cheshire, Yorkshire, Northumberland, and Durham, and in the centre and south-west of Scotland. The experiments were designed with a view to discover the most efficacious and most economical methods of manuring Potato crops. Preference is given to farmyard manure, and data are given showing its value and reliability. Details are also given of experiments with the combination of artificial and farmyard manure, the results being given in tabular form. In summarising the experiments, the author says (*l.c.* p. 449): "There is a very distinct indication in all the results that when farmyard manure is applied to the crop in a quantity as large as 15 tons per acre, artificial manures must be carefully selected and used with skill if their employment is to prove profitable, and that even when so employed the amount of profit per acre to be got from their use is not likely to be great. At any rate the addition to 15 tons of farmyard manure of the quantities of artificial manures employed in these experiments seem to have brought the total manurial application as closely as possible to the maximum profit point."

Incidentally other valuable information has been obtained on other points of practical importance. "One is the extent to which the effect of any manures applied to the crop is controlled by the inherent productive capacity of the particular variety of Potato grown. This was very well illustrated in the Cheshire experiments of 1899, where manures were applied to the two varieties, British Queen and Hough Giant. The application of farmyard manure, at the rate of 15 tons per acre, produced an increase in the yield of the British Queen of 9 tons 18½ cwt. Potatos, while in the Hough Giant the same manure gave an increase of only 7 tons 10 cwt. On two other plots a small dressing only was applied of a complete artificial manure, which produced an increase of yield in the British Queen of 7 tons 1 cwt. per acre; but only 3 tons 1¼ cwt. in the Hough Giant Potato. Both results indicated a capacity in the British Queen

Potato to respond to the application of manures in a degree quite impossible to the Hough Giant" (*l.c.* p. 440).—*R. N.*

NUTATION OF PISUM STEMS.

Nutation of Stems of Pisum (*Bei. Bot. Cent.* bd. 10, ht. 3, p. 128).—D. Neljubon has given an account of various experiments made with a view to discovering the cause of the horizontal nutation recorded under certain conditions for *Pisum sativum.* These experiments are fully detailed, and the results are decidedly interesting. They show that coal gas, and especially acetylene and æthylene, in the air of a laboratory produce a horizontal direction of the stems. This horizontal direction was not produced when the laboratory air was artificially freed of impurity, and appeared in seedlings grown in street air when this had been artificially impregnated with small amounts of these substances. There are two figures, and a full discussion both of these nutations and of the poisonous effects of small quantities of coal gas, SO_2, benzol, &c.—*G. F. S.-E.*

PARASITIC DISEASE.

Parasitic Disease, Predisposition of Plants to. By Paul Sorauer. (*Zeit. f. Pflanz.* bd. x. ht. 6, p. 352; January 1901).—This was the subject of an address by the veteran Prof. Sorauer, of Berlin, at a special meeting of plant pathologists attending the International Agricultural Congress at Paris last year. Case after case was quoted to show that the presence of a parasitic fungus in any locality need not result in an epidemic unless the plants acting as hosts are in a condition disposing them to attack. We give as a summary of the lecture the resolution passed by the meeting, which included most of the workers in diseases of plants from every part of Europe:—

"The methods in use at the present time for combating parasitic diseases of plants ought to be amplified by a course of preventive treatment for each species of cultivated plant. It is particularly advisable to encourage research on the means of defence possessed by plants against these diseases. The influence of soil, its improvement and manuring, deserves the special attention of observers. The hygiene of plants is indispensable, because experiments prove more and more that the propagation of disease depends not only on the presence of a parasite, but above all on the constitution, the general health, and the predisposition of the plant to attack. Efforts ought, therefore, to be made to modify those particular conditions of constitution and health which render the plant susceptible to disease."—*W. G. S.*

PLURALITY OF POLLEN GRAINS.

On the Influence exercised by a Plurality of Pollen Grains upon the Offspring. By C. Correns (*Bot. Cent.* 1900, 18, 422/435).—Experiments with *Mirabilis Jalapa* and *M. longiflora* demonstrated that the best results as regards constitution of the offspring were obtained by a liberal application of pollen grains as against a mere sufficiency. These species, which have very large pollen grains and a single ovary, are peculiarly

fitted for such experiments, and it was found that a majority of the grains, and either a minority or an equal number of the incipient seeds, were functionally incapable. Hence the need of a plurality of grains to secure fertilisation. Furthermore, from the fact that an abundance of applied pollen, over and above a sufficiency to secure fertilisation, led to stronger progeny, it is assumed that there arises thereby a competition between the grains, the most vigorous the soonest reaching the ovary by means of its tube. The race being to the strongest, the offspring profits accordingly. Such an experience certainly merits particular attention, and should be followed up by further trials for confirmation or otherwise.

C. T. D.

ROYAL AGRICULTURAL SOCIETY.

Botanist, Annual Report for 1900 of the Consulting. W. Carruthers (*Journ. Roy. Agric. Soc. Engl.* vol. lxi. (1900), pp. 731–741). —This article deals with diseases of plants, Ergot, which was supposed to have caused abortion, some noxious weeds and microfungi, of which the following may be noted:—

Fusicladium pyrinum (fig. 1, A to G).—This fungus is for the first time reported as injurious to the Pear in this country. It "appeared in little brown velvety patches, which spread rapidly, seriously injuring the leaves. The fruits had been attacked at an early stage, and were shrivelled and dried up beyond hope of recovery. . . . Spraying with Bordeaux Mixture has been followed with good results. It might be well to apply the mixture also during winter to the trees that have been diseased, to destroy any spores still remaining. All diseased leaves should be burned" (p. 732 *l.c.*).

Ascochyta pisi.—This fungoid pest is reported as injurious to Beans in Northamptonshire.

Sclerotinia sclerotiorum (fig. 3) is reported also as infesting Beans in Sussex. "The presence of the fungus can easily be detected by splitting the stem, when the black sclerotia of various sizes, some nearly as large as a pea, are plainly visible. . . . When an attack is discovered, the diseased stalks should be gathered and burned" (pp. 732–733 *l.c.*).

Æcidium grossulariæ.—It is recommended that the recurrence of this common parasite of the Gooseberry might be prevented by collecting and burning the diseased leaves and fruits (p. 734, *l.c.*).

Botrytis parasitica is reported as destructive to Tulip bulbs in Herefordshire. "The sclerotia of the Tulip disease have hitherto been described as growing on the bulbs, but in the specimen examined they appeared in great numbers on the leaves" (pp. 734, 735, *l.c.*).

Ovularia lactea.—This leaf parasite was found in Herefordshire infesting the Violet. "The mycelium burrows in the tissue of the leaf and produces on the surface little, erect, delicate branches that bear the colourless spores" (p. 735, *l.c.*).

Peronospora brassicæ.—This was found infesting leaves of the Broccoli, and the flowers of the same plants were attacked by bacteria (p. 735, *l.c.*).

Genista tinctoria (Dyer's Green-weed), fig. 6.—When eaten by stock this plant is said to give a disagreeable taste to the butter and milk. "If

the plant is abundant it would be advisable to break up the pasture, cultivate it well for two or three years with root crops, and then lay it down with good and suitable seed" (pp. 785, 786, *l.c.*).

Anthriscus sylvestris (Beaked Parsley), fig. 7.—Common in "woods and hedgebanks, sometimes spreading into fields. . . . Cases are recorded of this weed being injurious to stock; but this rarely happens, as it is universally avoided." The species should not be allowed to spread from seed (p. 786, *l.c.*).

Pulicaria dysenterica (Fleabane), fig. 8.—This plant occurs along ditch sides, streams, and headlands of fields. It should be destroyed (p. 786, *l.c.*).

Plantago media (Lesser Plantain), fig. 9.—"A common weed in lawns and pastures. . . . It may easily be distinguished from the larger Plantain by its smaller spike of flowers, which are lavender-coloured when in bloom, and by the leaves being without a stalk. This weed cannot be got rid of unless its perennial root is spudded out" (p. 787, *l.c.*).

Rhinanthus Crista-galli (Yellow Rattle), fig. 10.—This common plant is a root parasite. It is abundant in damp pastures and marshlands. To prevent the spread of the weed the plant should be cut while in flower (p. 787, *l.c.*).

Verbena officinalis (Vervain), fig. 11.—Reported from Hampshire as injurious to pastures. "Plants should be prevented from seeding, but the whole plant may be removed by pulling when the soil is soft with rain" (p. 787, *l.c.*).

Allium vineale (Crow Garlic), fig. 12.—"The whole plant is pervaded with a garlic taste and odour, which is communicated to the milk and its products. . . . To clear it out of a field where it is abundant it would be necessary to break up the field with a somewhat deep plough, and cultivate it, so as to clean the ground" (p. 788, *l.c.*).—*R. N.*

ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

Abies arizonica (Merriam); **A. lasiocarpa var. arizonica** (Masters). By C. A. Purpus, of San Diego, California (*Die Gart.* 36, p. 427; coloured fig.).—Discovered in 1896 by Dr. Hart Merriam on the mountains of Northern Arizona, where it was also seen by Purpus in the summer of 1900, and who considers it to be the most striking of all the West American Abies. It is especially distinguished by its peculiar cork-like whitish bark and blue-grey foliage, much resembling in colour that of *Picea pungens*.—*A. H. K.*

Abies lasiocarpa var. arizonica. By M. T. M. (*Gard. Chron.* p. 86; 9/2/1901).—The tree is very distinct for cultural purposes, the colour of the foliage surpassing that of *Picea pungens argentea*, and as it grows at an altitude of 7,000 ft., exposed to great cold, it should be

hardy in England and Scotland. Figures of the cone and bark are given at p. 52.—*G. S. S.*

Acer Negundo var. aureum odessanum. "Anon." (*Bull. d. R. Soc. Tosc. Ort.* 1, p. 28; January 1901).—Rothe, of Odessa, has obtained a sport of *A. Negundo*, whose leaves are of a crimsoned white edged with brown, and elegantly variegated with yellow, and are capable of resisting the injurious effects of the sun's rays. Described in *Le Moniteur d'Horticulture*.—*W. C. W.*

Adiantum modestum. By Prof. Underwood, of Columbia University (*Amer. Gard.* xxii. 321, p. 112; 16/2/1901).—Discovered recently in New Mexico by Prof. F. S. Earle. It appears to be closely related to *A. capillus-veneris* of Europe.—*C. C. H.*

Adiantum, vars. (*Rev. Hort. Belge*; February 1901).—Many remarkable varieties of *A. cuneatum* are described.—*G. H.*

Æchmea Weilbachii. By V. de Conene (*Die Gart.* 14, p. 158; two figs.).—A meritorious flowering plant for autumn and winter.—*A. H. K.*

Agapetes (Thibaudia) macrantha (*Garden*, p. 90; 9/2 1901; fig.).—Although introduced from Moulmain by Messrs. James Veitch in 1851, it is rarely seen in gardens. A plant was shown at R.H.S. on January 15, 1901.—*H. J. C.*

Agave Peacockii (*Amaryllideæ*), C. Mexico (*Bot. Mag.* tab. 7757).—Leaves sharply toothed, with green flowers and anthers. Flowered in the Palm House, Kew, December 1899; the flowering-scape being 14 ft. high.—*G. H.*

Algæ, New (*Bei. Bot. Cent.* bd. 10, ht. 3, p. 179).—Professor W. Schmidle, Mannheim, describes five new fresh-water Algæ from the Rhine districts. These are *Oscillatoria Lauterbornei*, *O. putrida*, *Aphanothece luteola*, *Cœlosphærium holopediforme*, and *Porphyridium Schinzi*.
G. F. S.-E.

Allium Erdellii. By W. E. Gumbleton (*Gard. Chron.* p. 287; fig. 104; 4/5/1901).—Recently introduced. Described and figured.
G. S. S.

Allium Ostrowskianum (*Liliaceæ*), W. Turkestan (*Bot. Mag.* tab. 7756).—It bears large umbels of rose-red flowers; from open border at Kew.—*G. H.*

Almonds and Peaches, Ornamental. By W. J. Bean (*Gard. Mag.* 2477, p. 248; 20/4/1901).—A full account of all the species and varieties comprised in the section Amygdalus of the large genus Prunus.
W. G.

Aloe Lynchii × (*Gasteria verrucosa* × *Aloe striata*). Anon. (*Gard. Chron.* p. 199; fig. 76; 30/3/1901).—*G. S. S.*

Aloe natalensis, Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 460, p. 170; May 1901).—Description of new species, from the Report of the Natal Botanic Gardens for 1900.—*G. S. B.*

Amarantaceæ, On the Geographic distribution of, in relation to their affinities. By G. Lopriore. (*Engl. Bot. Jahrb.* xxx. pp. 1–38, t. i.; 20/3/1901).—Adopting the generally recognised groups, the author gives a brief review of their morphology, especially that of the flower, emphasising the deviations from what may be regarded as the form typical of the family. The variations noted are correlated as far as possible with biological factors, such as pollination and seed-distribution, and an attempt is made to show the relation of genera or groups of genera to geographic areas.—*A. B. R.*

Amarylleæ, Hybridisation in. By A. Worsley. (*Gard. Chron.* p. 37; 19/1/1901).—The history of reputed hybrids is most carefully examined, with the result of throwing considerable doubt on the hybridity of the majority; in fact, after sifting all available evidence, there appears to be only twenty-seven hybrids of undoubted parentage out of forty-seven genera examined.—*G. S. S.*

Amelanchiers. By G. G. (*Gard. Mag.* 2481, p. 306; 18/5/1901). —A review of the cultivated species and varieties of Amelanchier, beautiful spring flowering trees and shrubs, popularly known as Snowy Mespilus or June Berry. An illustration of a fine specimen in flower at Kew accompanies the review.—*W. G.*

American Agricultural Products, Foreign Markets for. (*U.S. Dep. Agr. Rep.* 67).—"Testimony of Frank H. Hitchcock" before the Industrial Commission. This Report by the Chief of the Section of Foreign Markets contains much valuable information relative to the increase in the export trade of America. Unfortunately, the facts are not given in tabular form, but by a succession of questions and answers. We find that during the period of five years 1894–1898 the following has been the amount and value of American produce taken by Great Britain:—

	Annual Average.	Value, Dollars.	U.K. Percentage of American Export.
Indian Corn	50,000,000 bushels	18,000,000	43 %
Wheat flour	9,000,000 barrels	35,000,000	58 %
Cattle	350,000 head	33,000,000	95 %
Lard	194,000,000 pounds	13,000,000	36 %
Hams	111,000,000 ,,	11,000,000	81 %

Details are given regarding exports of Fresh Beef, Cured Meats, Oil-cake, Cottonseed Oil, Oleo Oil, Fruits, Cotton, Hogs, Bacon, Dairy Products, &c.

Most appear to show a very healthy increase, but Butter and Dairy Products seem to have declined in value, apparently owing to adulteration. Various suggestions are made with regard to Government inspection, the sending of special Agricultural Agents abroad to increase the sales; and it is also shown that cheap transport by rail and steamer has greatly assisted in developing the trade with the United Kingdom.—*G. F. S.-E.*

Amorphophallus leonensis (*Aroideae*), W Trop. Africa (*Bot. Mag.* tab. 7768).—It flowered at Kew 1899. There are four varieties in cultivation. It bears a solitary trisected leaf 8 ft. in length. The spathe is pyriform, of a dull purple, with a massive club-shaped, greenish-purple spadix, $2\frac{1}{2}$ in. in diameter.—*G. H.*

Anagallis grandiflora. By E. André. (*Rev. Hort.* p. 212; January 1901).—Coloured plate of very pretty varieties, with description. *C. T. D.*

An Anthracnose and a Stem-rot of the Cultivated Snapdragon. By F. C. Stewart (*N.Y. Agric. Exp. St. Bull.* 179; three plates; November 1900).—Anthracnose is a fungoid disease causing elliptical or circular sunken spots on the surface of the leaves and stems of the cultivated Snapdragon. The fungus is new to science, and is herein described, figured, and named. The name given is *Colletotrichum antirrhini*.—*D. H.*

Anemone japonica (*Rev. Hort. Belge*, June 1901).—The varieties of this plant are described.—*G. H.*

Anemones and Ranunculi (*Rev. Hort. Belge*, April 1901).—M. J. Burrenich contributes an article in recommendation of these genera and the best methods of their propagation.—*G. H.*

Anthurium Andreanum, var. Souvenir de Ed. Pynaert. With double coloured plate (*Rev. Hort. Belge*, May 1901).—This variety has a large, smooth, white spathe. The first variety, or hybrid, with this feature was raised by M. Mastner, of Vienna, in 1887, but this had a brilliant red (?) spadix. In the present one it is creamy white; the spathe is 8 in. wide and 6 in. across.—*G. H.*

Anthurium Bakeri. By N. E. Brown (*Gard. Chron.* p. 2; fig. 1; 5/1/1901).—Introduced from Costa Rica in 1871. Short description and figure.—*G. S. S.*

Apple Blossom. By Prof. E. S. Goff, of the University of Wisconsin (*Amer. Gard.* xxii. 332, p. 330; 4/5/1901; *id.* 333, pp. 346, 347; 11/5/1901).—A systematic study of the origin and development of the Apple Blossom.—*C. C. H.*

Apple 'Gideon.' By F. A. W. (*Amer. Gard.* xxii. 322, pp. 182, 183, fig. 34; 23/2/1901).—Raised by Mr. Peter Gideon, of Minnesota, and said to be of the same parentage as 'Wealthy.' Fruit large, good colour, firm texture and fine quality.—*C. C. H.*

Apple 'Newtown Pippin,' seedlings (*Amer. Gard.* xxii. 322, p. 184; 23/2/1901).—At the annual meeting of the Eastern New York Hort. Soc. on February 13, 1901, some seedling Apples, raised by Mr. S. W. Underhill, of Croton Point, were exhibited. They were the result of crossing 'Newtown Pippin' with 'Northern Spy,' 'Rhode Island Greening,' and other varieties, and all reproduced the good qualities of 'Newtown Pippin' with the further advantage of maturing and keeping much later than that variety. The most remarkable cross was that between 'Newtown Pippin' and a 'Russet,' which produced seedlings of attractive appearance and extraordinary dessert quality. The opinion of experts was that these crosses would revolutionise the Apple trade of America.—*C. C. H.*

Apples and Pears, Ornamental. By W. Goldring (*Gard. Mag.* 2479, p. 274; 4/5/1901).—A descriptive account of the finest species and varieties of Pyrus chiefly grown for the sake of their flowers. The review includes the species of Malus and Cydonia now included in the genus Pyrus. Illustrations of *P. Scheideckeri*, *P. coronaria flore pleno*, and *P. floribunda* accompany the review. In the following number (2480) the subject is continued, the sections Pyrophorum, Mespilus, Sorbus being dealt with by the same writer, and an illustration is given of *Pyrus Aria*. *W. G.*

Apples in the early years of the 19th century. By E. Bartrum, D.D. (*Gard. Mag.* 2478, p. 256; 27/4/1901).—An account of the history of various old sorts of Apples, based upon a list drawn up by the late Mr. Hooker, of Brenckley, Kent, whose name is intimately connected with the history of horticulture half a century ago. The account is of much interest to pomologists, and is continued in the following number (2479).—*W. G.*

Apples of the 'Fameuse' type. By Prof. F. A. Waugh (*Amer. Gard.* xxii. 327, p. 231; 30/3/1901; *id.* 328, pp. 248, 249; 6/4/1901).—A detailed history of the origin of these varieties with descriptions. *C. C. H.*

Apples, Topworking Young Trees. By Prof. G. H. Powell, Delaware Experiment Station (*Amer. Gard.* xxii. 320, pp. 92-94; figs. 22-27; 9/2/1901).—Showing the advantages of regrafting young Apple trees; with excellent illustrations.—*C. C. H.*

Arabis alpina, fl. fol. (*Rev. Hort. Belge*, June, 1901).—Described, and the cultivation of it, by M. Ad. Van den Heede. It is known to the French as *La Corbeille d'Argent*.—*G. H.*

Arctotis decurrens. By W. E. Gumbleton (*Gard. Chron.* p. 214; fig. 81; 6/4/1901).—A free blooming Composite from Namaqualand, introduced in 1900.—*G. S. S.*

Arundinaria anceps. By W. J. Bean (*Gard. Chron.* p. 24; 12/1/1901).—An account of this beautiful Bamboo. It was discovered

by Colonel Smyth in Garhwal, North-West India, in 1865, and seed was sent home by him and raised in Lincolnshire, where it grows to a height of 12 ft. or 14 ft. "in the gardens and woods," being very hardy and spreading rapidly.—*G. S. S.*

Asparagus Beds. By A. Petts (*Gard. Chron.* p. 41; 19/1/1901). —Describing how to make the beds and how to plant them.—*G. S. S.*

Asparagus Cookery. By H. Roberts (*Gard. Mag.* 2478, p. 258; 27/4/1901).—This subject, which is as important as the culture of Asparagus, is dealt with by the writer in detail, and describes many ways of dealing with Asparagus in the kitchen beyond the usual "plain boiled" way. *W. G.*

Asparagus Culture. By John J. T. Norfolk (*Journ. R.A.S.* vol. lxi. (1900), pp. 646 652).—For field culture a "thoroughly good deep yellow loam, well drained, and with a warm subsoil," is recommended, and the situation should be quite open to the south. The land should be prepared in the autumn, and stirred to a depth of at least two feet. The varieties recommended are 'Reading Giant' and 'Connover's Colossal.' "Planting may be done either by sowing the seed where it is to remain, or by using plants which have been raised elsewhere. If seed is employed, from the middle to the end of March would be the right time to sow; and if plants are used, the first week in April would be suitable, as the plants are much more likely to do well when they are beginning to grow than when they are dormant. Autumn planting should never be practised." The subsequent treatment is given in some detail, and when seed has been sown in wide drills it is permissible to plant short-topped varieties of Potatos between the rows for the first two years. For the garden the cultivation should be the same as for the field, the beds to be 42 inches wide and 5 feet apart. Three rows of plants should go to each bed, and there should be 9 inches between them and 1 foot between the plants in the rows. The beds should never be trodden upon, and cutting should always cease by the third week in June. For forcing, four-year-old roots which have not been previously cut from should be selected: these should be placed on a well-drained bottom and covered with three inches of fine soil. "Keep a bottom and air temperature of 65°," which should not be exceeded. Time about six weeks. To ensure a succession, put in fresh batches of roots every fortnight or three weeks.—*R. N.*

Asparagus Miner, American (*Amer. Gard.* xxii. 330, pp. 288, 289; fig. 62; 20/4/1901).—Discovered in 1896 by Mr. F. A. Sirrine on Long Island, N.Y. This pest is quite distinct from the European Asparagus fly.—*C. C. H.*

Asparagus Rust. Anon. (*Gard. Mag.* 2466, p. 63; 2/2/1901). —An account of the Asparagus Rust (*Puccinia asparagi*), a parasitic fungus well known in this country as infesting the Asparagus plants, and which has recently made its appearance in America. The suggestions for

preventive measures are discussed, though it appears that high culture and burning the affected growths are the best means of preventing the spread of the disease.—*W. G.*

Athanasia montana, Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 461, p. 171; May 1901).—Description of new species, from the Report of the Natal Botanic Gardens for 1900.—*G. S. B.*

Athrixia arachnoidea, Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 461, p. 170; May 1901).—Description of new species, from the Report of the Natal Botanic Gardens for 1900.—*G. S. B.*

Australian Economic Botany. By J. Plumer, Sydney (*Gard. Mag.* 2465, p. 59; 26/1/1901).—Note on the vegetable products of New South Wales, such as dyes, essential oils, and resins, from which it appears that this Colony is particularly rich in such products.—*W. G.*

Azalea indica, Madame Moreux. With coloured plate (*Rev. Hort. Belge*, June 1901).—This has enormous flowers; the petals crimson bases, shading off into white.—*G. H.*

Azalea indica, Paul Weber. With coloured plate (*Rev. Hort. Belge*, April 1901).—This has large double flowers, crimson petals with a white border.—*G. H.*

Banana in Samoa (*Rev. Hort. Belge*, Feb. 1901).—M. J. Burrenich gives a short account of the introduction of *Musa Cavendishi* (*M. sinensis*), a dwarf form. It was received from the Duke of Devonshire (in 1839?). Only one plant survived the transit, but from this individual all the bananas of Samoa have descended.—*G. H.*

Bathurst Burr (*Xanthium spinosum*). Anon. (*N. Z. Dep. Agri.* 8th Rep., p. 309; 1900).—"A shrubby annual, from 9 in. to 3 ft. high. Flowers are in clusters in the axils of the leaves. The seed is encased in a very hard oval burr, which is thickly studded with hooked prickles." Said to be a native of Chili, but occurs in many warm climates. In certain stages the plant is poisonous to all stock, and it causes great loss to the farmer by the burrs becoming entangled in the wool of sheep. In Australia wool is sometimes thus depreciated to the extent of 3*d.* or more per lb.—*R. N.*

Begonia 'Caledonia.' With coloured plate (*Rev. Hort. Belge*, June 1901).—This species has white flowers, about 1¼ in. across. It is interesting as being a sister-hybrid to 'Gloire de Lorraine.' Like that, the illustration shows it as very floriferous, and entirely male. It is also a late-flowering plant, but continues from October to March.—*G. H.*

Begonia 'Gloire de Lorraine.' With coloured plate (*Rev. Hort. Belge*, February 1901).—This valuable hybrid between *B. socotrana* and

B. Dregei is remarkable for its late flowering, and by being at first entirely male, for its long continuance, female flowers being subsequently produced.—*G. H.*

Begonias, Tuberous, On the Forcing of. By J. Rudolph (*Rev. Hort.* p. 45 ; January 1901).—*C. T. D.*

Begonia Tubers and Eelworms. By W. G. S. (*Gard. Chron.* p. 47 ; 19/1/1901).—A description of diseased tubers and the cause, with suggested remedies.—*G. S. S.*

Begonias, Winter-flowering. By E. B. B. (*Gartenflora*, p. 118 ; 1/3/1901).—Cultural directions. Crosses of varieties with the Begonia from the island of Socotra had yielded very good results. It crosses easily, and is so vigorous in its nature that its characteristics, as a rule, largely predominate in the seedlings resulting from the cross. But such seedlings are sterile, and the variety has to be maintained by cuttings. B. 'Gloire de Lorraine' had been obtained by Lemoine by a cross of *B. socotrana* with *B. Dregei*, a South African variety of no floral importance.—*C. E. S.*

Berried Plants. By G. Stanton (*Gard. Mag.* 2465, p. 48 ; 26/1/1901).—An exhaustive, descriptive list of all hardy trees, shrubs, and plants that bear attractive berries.—*W. G.*

Birch Trees, Disease of, in Epping Forest and elsewhere. By Robert Paulson (*Essex Naturalist*, vol. xi. p. 273, with 8 figs. ; July 1900).—After describing the disease, which effectually kills the trees, the cause is investigated and attributed to a fungus parasitic on the trunk and branches, called *Melanconis Hillostoma*, heretofore considered to be a saprophyte, attacking only dead tissues. The conclusion arrived at is that the Melanconis does occur on living branches, and causes their death, but, as a rule, reaches its perfection on dead branches only ; that the course of the disease is very rapid.—*M. C. C.*

Black Currant Mites and Gooseberry Caterpillars. By J. Riddell (*Gard. Mag.* 2466, p. 68 ; 2/2/1901).—The writer suggests that the planting of Raspberry in alternate rows with Black Currant bushes serves to attract the insects from the Currants. It is also asserted that the growing of Broad Beans among Gooseberry bushes secures immunity from caterpillars. The subject is worthy of investigation. *W. G.*

Black Rot, Conidia of (*Guignardia Bidwelli*). By M. G. Delacroix (*Bull. Soc. Myc. de Fr.* xvii. Fasc. 2, 1901, p. 133, with fig.).—Conidia resembling Cladosporium found on ripe grapes, developed from a sclerotium, discovered in France, in three localities.—*M. C. C.*

Border Plants (*Rev. Hort. Belge*, January 1901).—M. A. Buysseus recommends the three following: (i.) *Chlorophytum elatum, variegatum* (syn. *Anthericum Williamsi, Phalangium argenteo-lineare*) ; (ii.) *Calathea*

Kerchoviana (syn. *Maranta leuconeura, Kerchoviana*); (iii.) *Fittonia Verschaffeltii, argyroneura* (syn. *F. argentea*).—*G. H.*

Botanical Science, Promotion of. Anon. (*Gard. Mag.* 2463, p. 18; 12/1/1901).—A list of the prizes in money that are offered this year by the Paris Academy of Science to students for researches in botanical science. The sum of 9,700 francs is given in prizes apportioned among seven subjects.—*W. G.*

Box in Britain. By G. R. M. Murray (*Garden*, p. 28; 12/1/1901).—Deals with many interesting facts connected with 'The Box' throughout Great Britain. It is followed by an article on the same subject from the *Journal of Botany* by Cedric Bucknall.—*H. J. C.*

Brahea Roezli. By J. (*Bull. d. R. Soc. Tosc. Ort.* 2, p. 48; February, 1901).—A beautifully shaped Palm, two or more yards high, very ornamental, and capable, like *Chamærops excelsa*, of resisting very low temperatures; it can thus be planted in parks and gardens in the open air. The whole plant is covered with a silver-blue, rime-like substance which, contrasting with the green ground-colour, produces a charming effect. It requires little care, is uninjured by wind or drought, and is adapted to all kinds of soils provided they are not over-moist. The seeds are, however, difficult to germinate, and the plants, during the first years, grow with extraordinary slowness. They are cultivated at Ospedaletti, near San Remo, in the horticultural establishment, Riviera Ligure.
W. C. W.

Brazil, The Vegetation of Cabo Frio on the Coast of. By E. Ule (*Engl. Bot. Jahrb.* xxviii. pp. 511–528; 11/1/1901).—The author, who spent the month of October 1899 in this district (about 18 miles east of Rio Janeiro), gives an account of the various plant associations found there. The area includes sand dunes, marshes, the great salt lake of Araraunia, and the rocky island of Cabo Frio.—*A. B. R.*

Bromeliaceæ et Lauraceæ novæ vel adhuc non satis cognitæ. By C. Mez (*Engl. Bot. Jahrb.* xxx. Beibl. 67. pp. 1–20; 12/3/1901).—A number of new species are described, chiefly from Brazil and Central America.—*A. B. R.*

Buddleia Columbiæ. By E. André (*Rev. Hort.* p. 37; fig. 7; January 1901).—Recommended as handsome and long-flowering.—*C. T. D.*

Buff-tipped Moth. By F. M. Duncan (*Gard. Mag.* 2465, p. 49; 26/1/1901).—A life history of the Buff-tipped Moth (*Pygæra bucephala*), the caterpillar of which does so much harm to the foliage of such trees as the Lime, Oak, and Elm. Good illustrations are given of the moth, chrysalis, and caterpillar for identifying the insect.—*W. G.*

Bull. Bot. Dep. Jam.—Jan. 1901. Articles treating of Bastard

Logwood, Diseased Lemon Trees, Date Palms, Sunflower Seeds, and Oil of Eucalyptus.

Feb. 1901. On Grafting Mango trees.

March 1901. Articles upon Tobacco, Irrigation and Alkali Lands, Breadnut, Analysis of Cocoanut, Coffee Statistics, and Varieties of Banana.

April 1901. Articles on the Juniper Cedar of Jamaica and the Banana Conference.

May 1901. On the Oil of Akee, *Blighia* (*Cupania*) *sapida*. *G. H.*

Calla Æthiopica. (*Rev. Hort. Belge*, March 1901).—The German method of forcing this plant is described, so that flowers are obtained in December and January.—*G. H.*

Cannas, Forcing of, with list of varieties. By J. Rudolph (*Rev. Hort.* p. 89; January 1901).—*C. T. D.*

Caoutchouc from the Congo. By Louis Gentil (*Gard. Chron.* p. 262; 27/4/1901).—Produced from various plants, of which descriptions and methods of cultivation are given.—*G. S. S.*

Cape Weed (*Cryptostemma calendulaceum*). Anon. (*N. Z. Dep. Agri.* 8th Rep., p. 308; 1 fig.; 1900).—A native of South Africa, and is sometimes designated the Cape Dandelion, both in Australia and New Zealand. It is a soft herb rarely reaching one foot in height, flowers resembling a miniature sunflower. Is plentiful amongst Grass in the Auckland district, and is becoming common in Taranaki and Hawke's Bay. It is a very undesirable weed, and is said to taint milk.—*R. N.*

Carnations, Improvement of (Anon.) (*Gard. Mag.* 2469, p. 116; 23/2/1901).—Abstract report of an interesting and instructive address given by Mr. F. Dorner "On the Improvement of Carnations" before the Indiana Horticultural Society. A detailed account is given of the results of cross-fertilisation as affecting the colours of flowers thus experimented with. The paper may be useful to those engaged in this work, as the experiments appear to have been carried out in a methodical and thorough way.—*W. G.*

Carnation, The Improvement of the, in America. By C. W. Ward (*Trans. Mass. Hort. Soc.*; six plates; 1900).—The development of the Carnation from the gardener's point of view is fully described and illustrated. The author incidentally tells us how cut blooms may be kept fresh from two to three weeks, and also refers to the enormous Carnation trade of the United States, employing "something like 5,000, possibly more, people," receiving each an average wage of $45 a month.—*D. H.*

Cattleya × granuglossa (*Amer. Gard.* xxii. 318, p. 61; fig. 16; 26/1/1901).—A new hybrid raised by Mr. E. O. Orpet, of S. Lancaster, Mass., U.S.A., between *C. granulosa* and *C. amethystoglossa*.—*C. C. H.*

Cereus Wittii. By K. Schumann (*Gard. Chron.* p. 38; fig. 17; 19/1/1901).—A climbing Cactus from Manaos, Brazil, 1900, described as the missing link between the genera Phyllocactus and Cereus.—*G. S. S.*

Ceropegia debilis. By W. J. Odell (*Gard. Chron.* p. 238; fig. 89; 13/4/1901).—Figured for the first time; a short description of the plant is given.—*G. S. S.*

Ceropegia stapeliæformis, C. Gardnerii, C. Sandersoni. By G. Bellair (*Rev. Hort.* p. 109; figs. 37 to 39; January 1901).—With illustrations of each, descriptions of others, and cultural directions. *C. T. D.*

Chemical Constituents of different varieties of Apples. By Dr. Richard Otto (*Gartenflora*, p. 259; 15/5/1901).—With table of analyses. A valuable and interesting article.—*C. E. S.*

Chemical Constituents of the year's growth of Wood of Fruit Trees, in relation to the points of the Compass. By Dr. Richard Otto (*Gartenflora*, p. 177; 1/4/1901).—An important contribution upon an interesting question. Tables are given showing the analyses resulting from trials of certain varieties of Pears, Apples, and Cherries.—*C. E. S.*

Chimonanthus fragrans. By W. Crump (*Garden*, p. 125; 23/2/1901).—Recommended for its fragrance and as a winter flowering plant; hints as to cultural requirements. A comparison is drawn between it and *C. grandiflorus*.—*H. J. C.*

Chinese Primrose, Yellow, 'Rêve d'Or.' By E. André (*Rev. Hort.* p. 209; January 1901).—Semi-double, yellow, neatly white margined.—*C. T. D.*

Chinese Trees and Shrubs, New. By D. Bois (*Bull. R. Soc. Tosc. Ort.* 1, p. 26; January 1901).—Species of *Aristolochia*, *Pterocarya*, *Betula* (*Ort.* 2, p. 44; February 1901).—Species of *Carpinus*, *Corylus*, *Quercus*, *Castanopsis*, *Pinus*, *Abies*, *Thuia*, *Torreya*. All have been described in *Journ. de Bot.*, 1898–99.—*W. C. W.*

Chlorosis in Plants. Anon. (*Gard. Chron.* p. 40; 2/3/1901.)—Researches by Dr. Roux as to cause.—*G. S. S.*

Chrysanthemums. By H. Kohlmannstehner and G. Bornemann (*Die. Gart.* 18, p. 209; coloured fig.).—An account of last year's novelties, chiefly of those raised in Germany.—*A. H. K.*

Chrysanthemums. By H. Dauthenay (*Rev. Hort.* pp. 74, 121, and 165; January 1901).—New varieties with descriptions.—*C. T. D.*

Chrysanthemum Cuttings (*Rev. Hort. Belge*, April and May

1901).—M. A. Buyssens discusses the best periods for taking cuttings, the requisite soil, &c.—*G. H.*

Cider and Cider Fruits. By M. Lucien C. Baltet (*Jour. Soc. Nat. Hort. Fr.*; January 1901).—Recommends the establishment of a school of cider-making, with laboratories and means of determining the value of the products made from fruit of each variety; designating the qualities which any variety worth cultivating must possess. The use of liquid carbonic acid in the process of manufacture for export is recommended.
G. P.

Cladrastis tinctoria (*Leguminosæ*), W. U.S. (*Bot. Mag.* tab. 7767).—It is the "yellow" or "gopher" wood of N. America, one of the rarest trees, and confined to western bases of Alleghany Mountains, remarkable for its silvery bark, like that of the Beech. Only two other species are known in E. Asia, showing the affinity between the floras of N.E. Asia and N.E. America. A large tree is at Kew, from which the drawing was made. It bears compound racemes of white flowers.—*G. H.*

Climbers for Country Homes. By Byron D. Halstead (*New Jersey Agric. Exp. St. Bull.* 144; sixteen plates and thirteen other illustrations; June 1900).—A useful and interesting booklet, showing how the country house and its surroundings can be made more beautiful by the judicious use of suitable climbers and shade plants.—*D. H.*

Cockchafer (*Anoplognathus*) **Grubs destroying Strawberry Plants.** By W. W. Froggatt, Government Entomologist (*Agr. Gaz. N.S. Wales*, Vol. xii. Part 4, p. 478; April 1901).—Full information is given as to the manner in which the damage is done to the plants, description of the insects, with figures, and remedies to be applied.

Codlin Moth (*Carpocapsa pomonana*). By A. Petts (*Gard. Chron.* p. 32; fig. 15; 12/1/1901).—A description of this common pest, and how to deal with it.—*G. S. S.*

Cœlogyne Veitchii (*Orchideæ*), New Guinea (*Bot. Mag.* tab. 7764).—The flowers are sub-globular in form, ½ in. diameter, creamy white.—*G. H.*

Cold Chambers in Horticulture (*Bull. d. R. Soc. Tosc. Ort.* 2, p. 55; February 1901).—Useful for retarding vegetative period of plants. Plants most usually treated in this way are Lilies and Lilies of the Valley, as at Thomas Rochford's establishment at Cheshunt. After the usual flowering period of the plants has elapsed they are taken from the cold chamber and planted in the open, where they at length flower at an unaccustomed time.—*W. C. W.*

Conifers, Some Diseases of New England. A preliminary Report by Hermann von Schrenk (*U.S. Dept. of Agric., Div. Veg. Phys. and Path. Bull.* 25; fifteen plates; Aug. 1900).—This paper gives some

general information respecting the kind of fungi growing on forest trees and their relation to forest problems. It then describes the coniferous trees found in the New England forests, followed by detailed accounts of the occurrence and extent of injury by six or eight particular species of Polyporus, Trametes, and Agaricus.—*D. H.*

Convolvulaceæ, African. By Dr. A. B. Rendle (*Journ. Bot.* 457 and 458, pp. 12, 55; January and February 1901).—Descriptions of several new species of Ipomœa, Astrochlæna, Convolvulus, and Merremia. *G. S. B.*

Co-operation in Great Britain, Agricultural (*Ann. Ag.* p. 161; 25/4/1901).—*C. H.*

Cortusa. By G. Reuthe (*Gard. Mag.* 2476, p. 225; 13/4/1901).—Descriptive note on the two cultivated species in this interesting genus of hardy perennials allied to Primula. Both *C. Matthioli* and *C. pubens* are high alpine plants suitable for rock garden culture.—*W. G.*

Coryanthes Mastersiana. Anon. (*Gard. Chron.* p. 19; fig. 9; 12/1/1901).—Colombia, 1891.—*G. S. S.*

Cratægus, New American species of. By Angiolo Pucci (*Bull. d. R. Soc. Tosc. Ort.* 3, p. 75; March 1901).—*C. Engelmanni, C. Canbyi, C. Peoriensis, C. pratensis, C. submollis, C. dilatata, C. Holmesiana, C. Jonesæ.*—*W. C. W.*

Cratægus, New American Species of. By E. André, quoting Prof. Sargent (*Rev. Hort.* p. 111; January 1901).—*C. T. D.*

Crocus Marathonisius. By E. A. Bowles (*Gard. Chron.* p. 40; 19/1/1901).—A note on the apparent confusion of two distinct species under one name.—*G. S. S.*

Crops of 1900, The British. Anon. (*Journ. Bd. Agri.* vol. vii. No. 4, pp. 433–437; March 1901).—Official estimates are given of various crops, including cereals, Beans, Peas, Potatos, and other root crops. Potatos were considerably and Peas slightly below the decennial average. The estimated total produce of the Potato crop of Great Britain in 1900 is given as 2,735,000 tons, as against 3,077,000 in 1899; estimated at 4·87 per acre in 1900 and 5·62 in 1899.—*R. N.*

Crossing Plants, Experiments in. By Byron D. Halstead (*New Jersey State Agri. Exp. St. Rept.*; eight plates; Oct. 1900).—A report dealing with results of experiments in crossing Cucumbers, Lima Beans, Tomatos, Maize, and Salsify. A new species=hybrid of Tragopogon is described.—*D. H.*

Cucumbers, Fungus Diseases of. Anon (*Gard. Mag.* 2480, p. 294; 11/5/1901).—A paper read before the Massachusetts Horticultural

Society by Professer G. E. Stone, on the various forms of fungoid diseases which infest Cucumbers, Tomatos, and Lettuce when cultivated in and under glass. Among the ten fungus diseases peculiar to the Cucumber it is explained that what is called the "damping off" disease is due to a fungus, and remedies are suggested for this and other diseases. It is an instructive article, and English cultivators may glean some hints from it, as most fungoid diseases of plants are not peculiar to any country.
W. G.

Currants, Pruning. By Alger Petts (*Gard. Mag.* 2464, p. 33; 19/1/1901).—An instructive article, illustrated by diagrams, on the winter and summer pruning of Red and Black Currants.—*W. G.*

Cyperaceæ of the Flora of Russia. By K. Fr. Meinshausen (*Act. Hort. Pet.* tom. xviii. fas. iii.).—About 800 species with their synonyms are described, upwards of 200 being of the genus Carex.
C. W. D.

Cypresses, The. By M. Mouillefert (*Rev. Hort.* p. 231; figs. 86 to 99; January 1901).—*C. T. D.*

Cypripedium 'Col. de Villebois-Mareuil.' By M. Cappe-Vesinet (*Rev. Hort.* p. 131; January 1901).—*C. Charlesworthii* × *C. ciliolare.* Certificate and First Prize French Exhib. 1900.—*C. T. D.*

Cypripedium × longwoodense. By Oakes Ames (*Amer. Gard.* xxii. 333, p. 350; fig. 76; 11/5/1901; *Id.* 334, p. 366; 18/5/1901).—A new secondary hybrid orchid, flowered by Mr. J. E. Rothwell, of Boston, Mass., and raised from *C. Charlesworthii* and *C.* × *Lecanum Masreelianum.*
C. C. H.

Cypripedium × Simonii obscurum. *Nat. Hyb.* By Oakes Ames (*Amer. Gard.* xxii. 317, pp. 44, 45; fig. 11; 19/1/1901).—A supposed natural hybrid between *C.* × *Lecanum* and *C. insigne*, formerly thought to be a natural hybrid between *C. Spicerianum* and *C. insigne.* A coloured drawing of this plant is preserved in the library of the Massachusetts Hort. Soc.—*C. C. H.*

Cypripediums, a new race of continuous flowering hybrids. By Otto Froebel, of Zürich (*Die Gart.* 31, p. 361).—The author describes and illustrates three new hybrids raised by himself, of which *C. Chamberlainianum* is one parent in each case. One, which he names 'Zurigo,' from *C.* × *œnanthum* and *C. Chamberlainianum*; the second, 'Prince Hussein Kamil,' from *C. Boxalli superbum* and *C. Chamberlainianum*; and the third, not distinguished by name, from *C. Chamberlainianum* and *C. insigne Chantini.*—*A. H. K.*

Cypripediums. By H. J. Chapman (*Garden*, p. 218; 30/3/1901).—Cultural hints to beginners.—*H. J. C.*

Cytisus Adami, The Development of Buds and Bud-sports in. By M. W. Beijerinck (*Rev. Bot. Zeit.* 1901, 8, 114/18; with two figures, 1 and 2).—*C. T. D.*

Dahlia (*Rev. Hort. Belge*, March 1901).—Imperfections in the flowering are discussed by M. T. Burvenich, and attributed to a too rich soil, a too early planting, or too old a stock.—*G. H.*

Dahlia, the introduction of the, into Europe. By P. A. Saccardo (*Bull. d. R. Soc. Tosc. Ort.* 5, p. 189; May 1901).—An interesting article telling how this plant was discovered by the Spaniard, Hernandez, in the fifteenth century, in the Quauhuahu Mountains in Mexico, who brought it to Madrid, from which place it was subsequently introduced into England by the Marquis of Bute, afterwards into Italy, France, and Germany. *W. C. W.*

Date Trees in Spain (*Rev. Hort. Belge*, May 1901.)—Contrary to the usual opinion that dates do not ripen in S. Europe, there is at least one locality where trees produce excellent fruit. Elche is a small town near the Mediterranean which has an "oasis" of Date trees yielding excellent fruit equal to those of the Algerian Sahara. They were introduced and grown by the Moors when ruling Spain; to whom also was the introduction of the Orange due into Valencia and Portugal. The Dates are of a good variety. They are multiplied, just as the African Arabs used to do it, by separating the shoots from the base and not by sowing the stones. Twenty-five female trees are fertilised by means of one male.—*G. H.*

Delphinium 'Zazil.' By J. Rudolph (*Rev. Hort.* p. 32; January 1901).—Native of Afghanistan 1887. Flowers yellow; height 5 ft.; flowers large and numerous; vivid contrast with blue-flowering species; soil leafy, exposure very sunny; flowers June to August.—*C. T. D.*

Dendrobiums, Hybrid. By H. J. Chapman (*Gard. Mag.* 2471, p. 148; 9/3/1901).—A synopsis of all hybrid varieties of Dendrobium in cultivation. The parentage of each hybrid is given, and in most cases the name of the raiser and place of origin. The descriptive notes in many instances are insufficient for identification, but the list is undoubtedly valuable, as it includes no fewer than eighty-four hybrid varieties. The account is continued in the following number (2472).—*W. G.*

Dendrobium (Stachyobium) Jonesii, Rendle. By Dr. A. B. Rendle (*Journ. Bot.* 462, p. 197; June 1901.)—Description of a new species received by Mr. J. Sparkes from Mr. Arthur Owen Jones, J.P., North Queensland. The species is nearly allied to *D. gracilicaule*, F. Muell; and possibly identical with *D. gracilicaule* var. *Howeanum*, Maiden, from Lord Howe Island. It is tropical, and was flowered by Mr. Sparkes at Ewhurst, Surrey, in January 1901.—*G. S. B.*

Development of Buds in some of our common orchard fruits (*Am. Pom. Soc.* p. 40, 1899).—*C. H. H.*

Dolichos sesquipedalis. By L. Wittmack (*Gartenflora,* p. 108; 15/2/1901).—Description.—*C. E. S.*

Echeveria metallica (*Rev. Hort. Belge,* June 1901).—Referring to the article on vegetative multiplication, *cf. Pachyphytum,* a writer describes how seed of Echeveria can easily be obtained, and suggests a similar trial with that plant.—*G. H.*

Echinopsis Bentii (*Asclepiadeæ*), S. Arabia (*Bot. Mag.* tab. 7760). —It has a fleshy, cylindrical stem, 5 to 6 in., with oval pointed knobs and dark-crimson flowers. Flowered in a warm house, Kew.—*G. H.*

Eelworm Disease of the Chrysanthemum indicum. By Paul Sorauer (*Gartenflora,* p. 85; 15/1/1901).—Details characteristics of the disease. These nematoid worms, which Professor Ritzema Boss, Amsterdam, has identified with the *Aphelenchus olesistus,* appear to bear a certain resemblance to the Trechina which attacks man. These nematoids do not appear in the cells of the leaves attacked, but in the intercellular spaces, generally not far from the surface. Like the Chrysanthemum Rust, the ravages of this disease have appeared suddenly at various places. In the "Journal of Plant Diseases," by Boss, it is recorded that the same worm attacks Begonias and various Ferns, especially *Pteris cretica, Asplenium bulbiferum,* and *A. diversifolium.* The worm is probably introduced from the soil. Dr. Osterwalder found this to be the case with Gloxinias and Aucubas. Damp and sour soil seemed to induce the presence of these nematoids.—*C. E. S.*

Eel-worms on Cultivated Plants. (*a*) By Th. Cattie (Wageningen) and (*b*) by J. Hofer (Zürich) (*Zeit. f. Pflanz.* bd. xi. ht. 1, p. 34; March 1901.)—Two short papers on diseases of pot-plants caused by eel-worms or nematodes. The following are mentioned:—*Pteris Ouvrardi var. cristata,* varieties of *Pteris cretica,* and Asplenium showed dark discoloured patches on the leaves, and the plants died later. Chrysanthemums were attacked by a leaf disease in October and November; irregular spots appeared and the leaves fell off. Coleus and Salvia also showed leaf-spot. A similar disease is known on Begonia leaves. In all cases eel-worms were found in the diseased places, their identification being confirmed by Prof. J. Ritzema Bos as species of Aphelenchus.—*W. G. S.*

Elæagnus umbellata, Himalayas, China, and Japan. By E. André (*Rev. Hort.* p. 85; fig. 26; January 1901).—Strongly recommended as an ornamental hardy shrub; red persistent berries through winter, fine effect.—*C. T. D.*

Epi-Cattleya × Orpetiana. By Oakes Ames (*Amer. Gard.* xxii. 328, p. 251).—A new bigeneric hybrid of the second generation, raised by Mr. E. O. Orpet, of South Lancaster, Mass., out of *Cattleya amethystoglossa,* by *Epidendrum × O'Brienianum.* Like other hybrids of its class, the Epidendrum parent is pre-potent, and the pollen masses are more or less abortive.—*C. C. H.*

Epidendrum Claesianum (*Gard. Chron.* p. 70; fig. 27; 2/2/1901).—Discovered in Colombia in 1899 by M. T. Claes.—*G. S. S.*

Epidendrums, New Hybrids. By Oakes Ames (*Amer. Gard.* xxii. 382, p. 331; fig. 71; 4/5/1901).—Notes and drawings of three supposed hybrids raised by Mr. E. O. Orpet, of South Lancaster, Mass., between (1) *Epidendrum* × *O'Brienianum* × *E. elongatum*, (2) *E. cinnabarina* × *E. radicans*, (3) *Sophronitis violacea* × *Epidendrum* × *O'Brienianum*.—*C. C. H.*

Erica concinna Sol., and its varieties. By F. Bluth and L. Wittmack (*Gartenflora*, p. 169; 1/4/1901).—Description of new varieties, with illustrations.—*C. E. S.*

Ericas, Autumn-flowering. By L. Wittmack (*Gartenflora*, p. 8; 1/1/1901).—Gives Dr. Klotzsch's arrangement of species; names select varieties; and refers to the cultural treatise of Edward Regel. Illustrations of 10 varieties.—*C. E. S.*

Ericas, Cape, and their Culture. By Franz Bluth (*Gartenflora*, p. 6; 1/1/1901).—*C. E. S.*

Erythea armata (*Brahea Roezlii*). By M. Conrad (*Die Gart.* 21, p. 241, with fig.).—Highly commended as one of the hardiest, and at the same time one of the most useful, of decorative Palms. Introduced by Linden from Lower California. It inhabits the peninsula from the United States boundary to Cape St. Lucas.—*A. H. K.*

Ether in forcing Plants (*Rev. Hort. Belge*, Jan. 1901).—M. Johansen has studied the effect of this substance, and finds that it resembles the action of frost, in that plants like Lilac will not flower unless subjected to a low degree of temperature. By means of ether he has made Lilac blossom in October, the vapour of ether thus bringing about the internal chemical changes usually effected in the depth of winter during the period of repose.—*G. H.*

Eucalyptus and Malaria (*Bull. Bot. Dep. Jam.* March 1901).—It is thought by some that the Eucalyptus absorb so much moisture that they dry up the marshes where mosquitoes breed; but others think that these insects will not approach the trees. According to the experience of Mr. W. A. Sanders, living in the *Sequoia sempervirens* region of California, it appears that the latter is, at least, true in his neighbourhood. He planted a grove of *E. globulus* (now 140 ft. high). He says: "There has never been seen a single mosquito larva in the irrigating ditch from the spot where it enters the first shade of these trees to where it emerges from them 200 yards away; while above and below mosquito larvæ are plentiful."—*G. H.*

Fern Culture and Propagation. By C. T. Druery (*Garden*, p. 92; 9/2/1901).—A practical article, giving detailed particulars of methods of propagation.—*H. J. C.*

Ferns. By C. T. Druery (*Gard. Chron.* p. 199; 30/3/1901).—A *résumé* of all the remarkable discoveries concerning the germination, &c., of Ferns during the nineteenth century.—*G. S. S.*

Ficus radicans, variegata, with figure (*Rev. Hort. Belge*, May 1901).—This has lanceolate leaves with an irregular white border. It was introduced into commerce by Mr. Bull.—*G. H.*

Fig, Smyrna, in California (*Amer. Gard.* xxii. 315, pp. 3, 4; 5/1/1901).—Showing how the Smyrna Fig was introduced into California in 1881, but proved barren, owing to the flowers of the young plants being female only. Since then the Wild Capri Figs, with their pollen-bearing flowers, together with the fertilising insect bred therein, have been introduced, with the result that in 1901 the Smyrna Fig industry has been established in California on the same lines as have been carried out in the Mediterranean countries for generations.—*C. C. H.*

Flora of Africa, Contribution to the. XXI. By A. Engler (*Engl. Bot. Jahrb.* xxx. pp. 39 126, tt. ii. iii.; 12/3/1901).

New Cameroon Fungi. III. By P. Hennings (pp. 39–57.)—Two new genera and a number of new species are described, chiefly from Zenker's collections.

Contribution to the Algal Flora of Africa. By W. Schmidle (pp. 58–68, t. ii.).—The author describes small collections of fresh-water Algæ made in the hot springs at Lake Manjara by Neumann, and in Abolande (Cameroons) by a lady missionary, Frau Bohner.

Review of the species of Schrebera Roxb., a genus of Oleaceæ. By E. Gilg (pp. 69–74).—The author supplies a clavis, and a systematic arrangement of the genus, in which he recognises sixteen species, including several new ones.

Leguminosæ Africanæ. II. By H. Harms (pp. 75 94, t. iii.).—Includes a number of new genera and species, chiefly west tropical African, sent by various collectors.

Myrsinaceæ Africanæ. By E. Gilg (pp. 95 101).—The author describes new species of *Embelia*, *Ardisia* and *Mæsa*, which brings the number of Myrsinaceæ from tropical Africa up to thirty-five; only eleven were included by Baker in Oliver's "Flora of Tropical Africa" in 1877.

Amarantaceæ Africanæ. II. By G. Lopriore (pp. 102–110).—Includes a note on the limitation of the genera *Hermbstaedtia* and *Celosia*, and a description (with figure) of a new genus from Nyasaland, *Argyrostachys*, between *Alternanthera* and *Achyranthes*).

Acanthaceæ Africanæ. V. By G. Lindau (pp. 111–114.)—A few new species from tropical Africa and the Transvaal.

Caricaceæ Africanæ. By I. Urban (pp. 115–117; with figure).—The author establishes a new genus from tropical Africa, *Cylicomorpha*, intermediate between *Carica* and *Jacaratia*.

Gramineæ Africanæ. By R. Pilger (pp. 118–126.)—A few new species and varieties from east and west tropical Africa.—*A. B. R.*

Flora, Contributions towards the Study of the Portuguese. By J. de Mariz (*Bol. Soc. Brot.* xvii. p. 159, 1901).—Embodies an exhaustive research on the synonymy and distribution—interspersed with critical notes—of all Portuguese plants belonging to the orders Convolvulaceæ, Cuscuteæ, and Solanaceæ.—*G. M.*

Flora of Central China (conclusion). By L. Diels (*Engl. Bot. Jahrb.* xxix. pp. 577–659; 12/2 1901).—This so-called flora, which is concluded in this number, is a list of plants compiled from existing literature, with the intercalation of new species contained in the Berlin Herbarium. It is neither critical nor exhaustive.—*A. B. R.*

Flora of Eastern Asia, New Species of the (Manchuria and Northern Korea). By V. L. Komarov (*Act. Hort. Pet.* tom. xviii. fas. iii.).—Forty new species of plants and shrubs are described. Ten of them belong to the genus Carex. Of the rest some are likely to be valuable acquisitions to horticulture. The following three seem especially noteworthy, viz.:—

Primula saxatilis, allied to *P. cortusoides*, flowering in June (Northern Korea).

Clematis (Atragene) koreana.—A trailing, not a climbing kind, with large sulphur or violet-coloured flowers in June (Northern Korea).

Silene capitata.—A perennial about a foot high, described as very ornamental and quite distinct from all others of the genus. It flowers abundantly in July and August, the colour being bright rose. Native of rocky river banks in Manchuria and Korea.

The distinctive characters of each plant are very clearly given, especially those in which it differs from the nearest known species.

C. W. D.

Flora of the Rochers de Naye. By G. Reuthe (*Gard. Mag.* 2477, p. 242; 20/4/1901).—Account of a visit by the writer to this beautiful alpine region. The plants met with are enumerated, and these include some of the rarest alpine plants.—*W. G.*

Flora of Vavau. By I. H. Burkill; with a short account of its Vegetation by C. S. Crosby (*Journ. Linn. Soc.* p. 20; April 1901).—Vavau is one of the northern Tonga or Friendly Islands. A summary of previous collections made in these Islands was published by Mr. Hemsley in 1894, "The Flora of the Tonga or Friendly Islands," in which he enumerates 308 Phanerogams and 83 vascular Cryptogams. Six months

after the publication of this work Mr. Crosby's collection was received, containing 262 Phanerogams and 27 vascular Cryptogams, 83 of which are additional to Mr. Hemsley's list.—*G. S. S.*

Forestry of the German Empire. By Herr Königl. Forstmeister Kottmeier (*Gartenflora*, p. 97; 15/2/1901).—*C. E. S.*

Fruit Crop, Disposing of. By D. Scott (*Agr. Gaz. N.S. Wales*, Vol. xii. Part 3, p. 370; March 1901).—A short article pointing out the great necessity of improved systems of disposing of the fruit crop, for the writer shows that in spite of an exceptionally good crop of clean, good fruit (Japanese Blood Plums), carefully picked and well marketed, he was about £4. 3*s*. per acre out of pocket on the year's cash outlay, without reckoning anything for interest or capital invested.—*A. W. S.*

Fruit Culture Experiments. By H. J. Wright (*Gard. Mag.* 2481, p. 301, 18/5/1901).—A discussion of the results of experiments in fruit culture and their value, based chiefly upon observations at the Woburn experimental fruit farm. Comments on the experiments made there upon fruit tree stocks, manures, surface cultivation, and planting are given in this and the following number.—*W. G.*

Fruit-growing in California. By W. Th. Goethe (*Gartenflora*, p. 123; 1/3/1901; and p. 150; 15/3/1901).—Deals with picking and packing the fruit. Also an interesting account of experiments on scale-infested trees, from which it appeared that trees if grafted on certain stocks remained healthy, notwithstanding the pest. Quince, as a stock for Pears, was condemned; but Pears if grafted on William's Bon Chrétien appeared to improve greatly, even in flavour. Thirty-six varieties were so grafted with success.—*C. E. S.*

Fruits, Hardy, from Seed. By G. B. Mallett (*Gard. Chron.* p. 152; 9/3/1901).—Advice and encouragement to all who desire to improve the varieties of our hardy fruit trees.—*G. S. S.*

Fruit Keeping. By Obergärtner Greinig (*Gartenflora*, p. 217; 15/4/1901).—Three conditions are described as essential, viz.: Not too dry an atmosphere, an even low temperature, and ventilation with pure air. Rotting vegetable matter in a fruit room speedily contaminates the fruit.—*C. E. S.*

Fruit Reports (*Am. Pom. Soc.* p. 155, 1899).—From the various States in answer to questions relating to:—

(1) Fruit sections in the State.

(2) Soil and elevation at which the fruits thrive best; price of good orchard land and bearing orchards.

(3) Varieties of various fruits of greatest value for commercial planting.

(4) Cultivation—What crops are grown in young orchards?

(5) Cover crops—Are winter cover crops grown?

(6) Fertilisers generally considered profitable.

(7) New varieties—What promising new varieties have originated in your State?

(8) Insects and diseases—What most troublesome, what remedies found of most value?

(9) Irrigation—Method employed.

(10) Statistics—Area devoted to various fruits? What are some of the larger orchards, and what has been value of crops? At what price must the various fruits sell in order to repay expense of growing? What is estimated value of fruit shipped from your State?

(11) Evaporated fruits.

(12) Hardiness of species and varieties—To what extent have various species of fruit been injured by the winter? What has been the relative hardiness of the leading varieties of each.—*C. H. H.*

Fruit Tree Pruning Competition. By A. Dean (*Gard. Mag.* 2478, p. 255; 27/4/1901).—An account of a recent competition in fruit tree pruning among members of the Madresfield Club, at Madresfield. Much instruction may be gleaned upon fruit tree pruning from this explicit account of the proceedings.—*W. G.*

Fruit Trees from Seed. By C. G. Patten, of Charles City, Ia. (*Amer. Gard.* xxii. 335, pp. 379, 380; 25/5/1901).—The author deprecates too much mixing of varieties by crossing, and suggests that the first crosses that have proved good should be pollinated with their own pollen, thus inducing pre-potency by inbreeding and lessening the chances of reversion.—*C. C. H.*

Fruit Trees in Heavy Soils. By L. N. N. (*Gard. Mag.* 2470, p. 124; 2/3/1901).—Interesting discussion, but bearing more upon the synonomy of certain sorts of Pears and Apples than their relation to certain soils, heavy or light.—*W. G.*

Fuchsia "Andenken an Heinrich Henkel." By F. Rehnelt (*Die Gart.* 27, p. 31; fig. originated from a cross between *F. corymbiflora* and *F.* × *magnifica*).—Recommended for its distinct long-tubed reddish-carmine flowers and elegant foliage.—*A. H. K.*

Fumigation for Insect Pests. William E. Bear (*Jour. Roy. Agricul. Soc. Eng.* vol. lxi. (1900), pp. 263–291).—The author passes in review the history and treatment of fumigation, referring chiefly to the use of hydrocyanic acid gas. The paper is ostensibly compiled and illustrated chiefly from the official Bulletins of the United States and our official Colonial publications. In reviewing the experiments conducted in England, Mr. Bear refers to the Wye College experiments in the use of hydrocyanic acid gas for fumigating Vines and plants under glass, and also to its supposed successful application against the Black Currant bud-mite. Its failure, however, as a remedy against this pest has already been pointed out to the Fellows of the Royal Horticultural Society (Journal, vol. xxv. p. 266, April 1901).—*R. N.*

Fumigation (Tree) in California. Chas. P. Lounsbury (*Agricult. Jour. Cape of Good Hope*, vol. xviii. (1901), pp. 210–223; with illustrations).—This paper gives the result of the author's visit to the great Orange-growing district of the United States, and describes in detail the American systems of fumigation with hydrocyanic acid gas.—*R. N.*

Fungi from the West Indies. By Annie Lorrain Smith (*Journ. Linn. Soc.* p. 1; pls. 1–3; April 1901).—The species named and described were with one exception collected in Dominica by Mr. W. R. Elliot under the auspices of the West India Natural History Exploration Committee. The specimens are now in the Herbarium of the British Museum.—*G. S. S.*

Fungus Diseases Common to Cucumbers, Tomatos, and Lettuce under Glass. By Prof. G. E. Stone (*Trans. Mass. Hort. Soc.* 1900).—A short but lucid paper. Methods of soil sterilisation to destroy fungal and nematode plant parasites are described.—*D. H.*

Gaillardia perennis. By J. Rudolph (*Rev. Hort.* p. 19; January 1901).—Notes on eight new varieties, described.—*C. T. D.*

Geigeria rivularis and **G. natalensis,** Wood & Evans. By J. Medley Wood and M. S. Evans. (*Journ. Bot.* 461, pp. 171 2; May 1901).—Descriptions of new species, from the Report of the Natal Botanic Gardens for 1900.—*G. S. B.*

Gladiolus, the Modern. By Leonard Barron (*Amer. Gard.* xxii. 319, pp. 75, 76; 2/2/1901).—A short history of the evolution of the modern Gladiolus by hybridisation.—*C. C. H.*

Gourds. By W. Balke (*Die Gart.* 28, p. 325, with three figs. of ornamental vars.).

Grafting of Flower-buds on Syringa vulgaris. By X. (*Bull. d. R. Soc. Tosc. Ort.* 4, p. 109; April 1901).—A cheap and easy method of obtaining forced flowers of Lilac every winter consists in grafting strong shoots bearing latent flower-buds, 15–20 cm. in length, taken from shrubs growing in the open, on to the ends of branches of plants in the stove which have already flowered, the graft to be inserted between the wood and cortex of the subject. In ten to twelve days the buds begin to burst, and flowering takes place after twenty days. The inconvenient part of this method is the longer time which the forcing takes, which would hardly suit private growers with a limited number of plants. But in the article there is another method of grafting mentioned which would seem to obviate this.—*W. C. W.*

Grafting, recent work in (*Amer. Gard.* xxii. 326, pp. 205, 206; 23/3/1901).—A review of Prof. Daniell's experiments in grafting distinct plants on one another. In Rosaceæ, Leguminoseæ, and Cruciferæ the limits of successful grafting appear to be confined to genera of the same

tribe. With Solanaceæ and Umbelliferæ grafts were successfully made between distinct tribes; while with Compositæ the limit of grafting seems to be the sub-family.—*C. C. H.*

Grafting Walnuts and Hickories. By G. W. O. (*Amer. Gard.* xxii. 331, pp. 307–309; figs. 65, 66; 27/4/1901).—The usual difficulties are overcome by Mr. W. P. Corsa, of the Department of Agriculture, by the use of an incubator.—*C. C. H.*

Grass Land, Mixed Herbage in. By J. J. Willis (*Gard. Mag.* 2462, p. 4; 5/1/1901).—Abstract account of results of experiments on mixed herbage of permanent grass land conducted for many years in succession on the same land at Rothamsted by Sir John Lawes and Sir Henry Gilbert. The account may be useful to gardeners and others having the care of grass lands.—*W. G.*

Guavas (*Rev. Hort. Belge*, April 1901.)—M. J. Burvenich describes the tree *Psidium pyriferum* as growing spontaneously in the West Indies and S. America, whence the Guava has been introduced into Africa and the East Indies. Several varieties are also described.—*G. H.*

Hamamelis mollis. By W. J. Bean (*Gard. Mag.* 2468, p. 92; 16/2/1901).—A newly introduced species of Hamamelis (Witch Hazel) from Central China, discovered by Dr. Henry in 1887. It was introduced by Messrs. Veitch, in whose nursery at Coombe Wood it has flowered. With this addition there are now three species of Hamamelis in cultivation.—*W. G.*

Hardy Plants in Flower in Winter. By G. Reuthe. (*Gard. Mag.* 2463, p. 20; 12/1/1901).—Notes on the flowering of rare Irises of the Juno, reticulata, and Apogon groups in mid-winter near London, together with the flowering of Croci and other bulbous plants.—*W. G.*

Helianthus cucumerifolius (*Rev. Hort. Belge*, April 1901).—In an article upon this species, with two illustrations, the writer points out its advantages as flowering all the summer, and in being of great variability by seed, as it is an annual. In a group nearly every individual is different, and thus it produces a remarkably good effect.—*G. H.*

Helminthosporium, Diseases of Barley and Oats caused by. By F. Kölpin Ravn (Copenhagen) (*Zeit. f. Pflanz.* bd. xi. ht. 1, p. 1; figs. 1 to 8; plates i, ii; March 1901).—A research on a disease important to the agriculturist, and observed by us in Britain last year. The author takes up the identification of the fungi concerned; he distinguishes two species of Helminthosporium on Barley and one on Oats, and investigates and illustrates stages in the life histories. The agricultural aspects of the disease and its prevention are reserved for future work.—*W. G. S.*

Hermaphrodism, False, and other Malformations of the Oogonia of *Nitella syncarpa.* By Ernest Alfred (*Flora* 1891, Pt. 1, p. 1,

figs. i.-iii.).—In the plant found spermatogenous filaments grew within the "nucule" or archegonium, chiefly from the transition-cells (*Wendezellen*) below the oocyte.—*M. H.*

Hibiscus Manihot (*Malvaceæ*), China and Japan (*Bot. Mag.* tab. 7752).—An annual with yellow flowers having a purple eye, 6 in. diameter, grows from 4 to 9 ft. in Temperate House, Kew.—*G. H.*

Hyacinth Disease, Wakker's (*U.S. Dep. Agri. Bull.* 26; 1901).—Mr. Erwin F. Smith gives a very full and detailed account of the *Pseudomonas hyacinthi* (Wakker), Erw. Sm., illustrated by a plate showing cultures and characteristic symptoms of the disease. The organism is yellow and rod-shaped, and can swim readily by means of a long polar flagellum. It enters the Hyacinths either through wounds on the leaves or blossoms (probably carried by insects), and multiplies in the vascular system, filling the vessels, especially those of the bulb, with a bright yellow slime consisting of bacteria. It can be recognised by the yellow strips on the leaves, or yellow dots, corresponding to the xylem vessels of the bulb-scales. Sometimes the disease is propagated through the young bulb being infected by the diseased bulb from which it springs. The paper gives records of nineteen series of inoculations and experiments, and should be remembered in any case of Hyacinth disease.—*G. F. S. E.*

Hybrid Stocks, with respect to the Limits of the Mendellian Law. By C. Correns (*Bot. Cent.* 1900, 84, 97/118).—In experiments with *Matthiola incana* and *M. glabra*, this investigator found that it was only in some respects that Mendel's Law of Separation was confirmed, its application being therefore limited. As we have only a brief abstract before us in the *Bot. Zeit.* 1901, 6, p. 86, the paper itself must be referred to for full details.—*C. T. D.*

Hydrangea Hortensia 'Jeanne d'Arc.' By H. Dauthenay (*Rev. Hort.* p. 66; fig. 19; January 1901).—Sport from 'Thomas Hogg'; pure white, brownish-black stems and stiff habit.—*C. T. D.*

Hymenanthera crassifolia. By S. Mottet (*Rev. Hort.* p. 115; 2 figs.; January 1901).—A Cotoneaster-like wall plant, not tender as reputed. White or spotted berries, persisting through winter.—*C. T. D.*

Hymenocallis schizostephana (*Amaryllideæ*), Brazil (*Bot. Mag.* tab. 7762.)—This bears fragrant flowers with a long, slender, greenish tube and linear white lobes. It flowered in a warm greenhouse in June. *G. H.*

Hypericum, the genus. By Angiolo Pucci (*Bull. d. R. Soc. Tosc. Ort.* 5, p. 145; May 1901).—Interesting description in brief of the European species of this genus.—*W. C. W.*

Illicium laurifolium. By Ed. André, with figure (*Rev. Hort.* p. 17; fig. 1; January 1901).—Semi-shady culture recommended in non-calcareous peaty soil.—*C. T. D.*

Impatiens grandiflora (*Gard. Chron.* p. 110; fig. 47; 16/2/1901).—Introduced in 1900 by Mr. Warpur from Madagascar.—*G. S. S.*

Imports of Agricultural Produce. Anon (*Jour. Bd. Agri.* vol. vii. No. 4, pp. 462–470).—This article deals with imports of live animals (for food) and dead meat, dairy produce, horses, poultry, grain, and flour. The following figures are taken from the Table of Imports of Vegetable Produce:

Description	Quantities 1899	Quantities 1900	Values 1899	Values 1900
			£	£
Onions . . . . bush.	7,018,299	7,082.334	845,752	853,903
Potatos . . . . cwts.	5,159.011	8,903,534	1,577,726	2,232,342
Vegetables unenumerated (including Tomatos) . .		--	1,744,558	1,557,733
	bush.	cwts		
Apples	3,861,172	2,128,477	1,186,143	1,224,655
Pears	571,832	476,908	266,351	366,871
Plums	558,273	423,019	294,052	392,696
Cherries	281,236	242,505	153,642	308,395

R. N.

Increase, Two Opposing Factors of. By Prof. J. C. Arthur (*Bull. Bot. Dep. Jam.* February 1901).—After describing the antagonistic powers of a plant's "vegetative" and "reproductive" energies, the author generalises that "a decrease in nutrition during the period of growth of an organism favours the development of the reproductive parts, while abridging the vegetative parts." Conversely, "An increase in nutrition favours the vegetative parts, while abridging the reproductive parts is equally true." He then discusses the respective values of small and large seeds. The result being that not only do larger seeds produce more stem and foliage, but a proportionally greater increase in the fruit. Thus 188 grams each of large, medium, and small peas were sown upon equal-sized plots of ground; and although there were twice as many small seeds as large, and nearly one and a half as many medium seeds as large, still the harvest was greatly in favour of the larger seeds, both per acre and per plant. The author's second generalisation is, therefore, as follows:—"Large seeds give rise to plants with a greater development of the reproductive parts and less of vegetative parts than small seeds do." He adds that these results become not only acquired but inherited. Interesting tables follow giving statistical details.—*G. H.*

Injurious Insects. Report of Entomologist (Dr. J. B. Smith) to the New Jersey Agric. Coll. Exp. St. (four plates and several other illustrations; October 1900).—General outline of year's work, with detailed descriptions of spraying operations. An interesting account of a European trip made in the interests of economic entomology is also given in the Report.—*D. H.*

Insecticides. By S. (*Garden*, p. 286; 20/4/1901).—Useful formulæ are given and the best insecticides recommended.—*H. J. C.*

Insecticides (*Rev. Hort. Belge*, January 1901).—The following receipts are recommended against crickets and cockroaches:—(i.) Borax, 2 parts; flour, 1 part. (ii.) Borax, 2 parts; powder of Pyrethrum, 2 parts; flour, 1 part. (iii.) Borax, 2 parts; powder of Pyrethrum, 2 parts; powder of Colocynth, 1 part; flour, 1 part.—*G. H.*

Ipomœas, Japanese. By Wilhelm Mühle, junr. (*Die Gart.* 22, p. 260).—Coloured fig. of fourteen vars., and fig. of twenty-five forms of leaves in outline.—*A. H. K.*

Iris Tauri. By G. B. Mallett (*Gard. Chron.* p. 190; fig. 74; 23/3/1901).—Description and figure.—*G. S. S.*

Iris Tubergeniana. By G. B. Mallett (*Gard. Chron.* p. 190; 23/3/1901).—Described. *G. S. S.*

Iris Willmotiana. By M. Foster (*Gard. Chron.* p. 261; fig. 100; 27/4/1901).—A new species introduced from Eastern Turkestan in 1890. Described and figured.—*G. S. S.*

Irrigation, Progress in the Study of (*Bull. Bot. Dep. Jam.* Jan. 1901, p. 2).—Apart from the drier western, even the more eastern and humid regions of U.S. are benefited by irrigation; for the rainfall in Wisconsin does not supply sufficient moisture for maximum crops, the profit from irrigation on Corn* being $2.16 per acre, and for Potatos $11.70, &c. Irrigation should not be excessive, as the fertilising materials may be washed away. M. Edmond Gain found that "at the time of planting the soil should have about 25 per cent. of the total amount of water which it is capable of holding, then it should fall to 15 per cent., and remain at this point until the first leaves are formed, when it should be raised quickly to nearly 40 per cent. It should be allowed to fall rapidly to about 25 per cent., and remain at this point until shortly before flowering, when it may be raised gradually to 40 per cent. and then allowed to fall rapidly to 12 or 15 per cent., where it remains during fruiting and maturity." These ideal conditions of alternate dry and wet periods should be aimed at, if they cannot be actually secured, as it is the best method of keeping the soluble constituents of the soil near the surface. On "akali" soils, however, under the above conditions the corrosive poisonous alkaline salts would accumulate at the surface, to the destruction or great injury of the crop.†

Sub-irrigation on a large scale by drain-pipes is not so effective as surface irrigation by furrows in increasing the yield of field crops; but for garden crops, *e.g.* Celery, &c., drain pipes first laid *upon* the soil parallel with the young plants, and then covered as the rows are banked, proved very efficacious, the water being poured in at one end, the other being, of course, blocked.—*G. H.*

Ivy as a Border Plant (*Rev. Hort. Belge*, February 1901).—Is recommended by M. J. Burvenich.—*G. H.*

* Presumably Indian Corn or Maize.

† This is specially dealt with in the March number, p. 36.

Jamaica Gardens. By W. J. (*Garden*, p. 314 *et seq.*; 4/5/1901). —Dealing with local plants, their particular characteristics and useful purposes; also referring to Fencing and the tools as used.—*H. J. C.*

Japanese Flower Arrangement. By Hugo Müller (*Wien. Ill. Gart.-Zeit.* p. 172). A suggestive account of the arrangements of cut flowers and sprays according to the Japanese canons. As a rule the Japanese bouquet has few flowers, but a few sprays and flowers grouped on fixed lines. An irregular, upright, spreading spray; from this radiate from two to eight horizontal lines with drooping habit. –*G. P.*

Juniperus chinensis var. Pfitzerianum Hort. Späth. (*Die Gart.* 34, p. 402: fig.).—A stately variety of the Chinese Juniper that originated in the nursery of Mr. Späth, near Berlin, and which has attracted the admiration of visitors for some years past. It is well distinguished by its slightly pendulous habit and grayish-green foliage, and has proved quite hardy in North Germany.—*A. H. K.*

Just. Bot. Jah. Vol. xxvi. (for 1898).—Abth. ii. Heft. iii.; 1901. Contains abstracts of papers on *Diseases of Plants, Pollinating and Disseminating Devices, Galls,* and *Injuries done to Plants by Animals.* Vol. xxvi. (for 1898). Abth. ii. Heft. iv.; 1901. Contains abstracts of papers on *Teratology and Variations, Palæo-botany, Biography;* and is the *Index* number. Vol. xxvii. (for 1899). Abth. i. Heft. ii.; 1901. Contains abstracts of papers on *Algæ, Bryophyta,* and *Geographical Distribution of Plants.*

Kalanchoë Bentii (*Crassulaceæ*), S. Arabia (*Bot. Mag.* tab. 7765). —Herb 3 ft. high, with long, fleshy, pointed leaves, differing in this respect from all other species. It has large corymbs of tubular flowers, 2 in. in length, green below with a pink limb.—*G. H.*

Kalanchoë farinacea (*Crassulaceæ*), Socotra (*Bot. Mag.* tab. 7769).—Discovered by Dr. Balfour in 1880. It flowered at Kew in 1900. It has obovate leaves 2 in. in length, with panicles of flowers ½ in. long, golden yellow at the base with a crimson border.—*G. H.*

Kennedya audomariensis, Hort. *Leguminosæ,* hyb., *K. bimaculata* × *K. Marryattæ* (*Rev. Hort. Belge,* February 1901).—As figured, it has simple lanceolate, exstipulate leaves and small rose-coloured flowers. The genus is of New Holland.—*G. H.*

Kew Bulletin.—The Appendix I. (1901) of the current year's issue of the *Bulletin of Miscellaneous Information,* published at the Royal Gardens, Kew, contains a list of seeds of hardy herbaceous plants and of trees and shrubs. The list of seeds collected in the Arboretum is particularly interesting, as it shows what a large number of species produce ripe seeds, and that in some cases pure hybrids produce fertile seeds. Notable instances are *Rhododendron kewense, Philadelphus*

Lemoinei, *Cytisus præcox*, and *Hypericum Moserianum*. Similar instances occur in the list of herbaceous plants.

Appendix II., 1901, contains a list of additions to the Catalogue of the Library of the Royal Gardens, which is a supplement of the Catalogue issued as vol. iii. of the *Kew Bulletin*. The list includes not only botanical works, but many horticultural books, new and old, not a few of which have long been out of print and are rare.—*W. G.*

Laburnum Adami, Poir, **Anatomy and Morphology of** (*Bei. Bot. Cent.* bd. 10, ht. 3, p. 144).—Dr. R. Lambert gives a full discussion of the anatomical details of the hybrid *Laburnum Adami*, Poir, of *Cytisus purpureus*, and of the branches resembling the latter plant which appear on *L. Adami* as bud variations. These branches do not essentially differ from those of the true *C. purpureus*, but are very different both anatomically and in their general appearance from the branch of the hybrid which produces them. As a study of the anatomy of hybrids this paper should be consulted, and the photographs illustrating the origin and appearance of these peculiar branches are most interesting.—*G. F. S.-E.*

Lælia grandis tenebrosa (*Rev. Hort.* p. 68; coloured plate; January 1901).—Brazil 1850, reintroduced 1864.—*C. T. D.*

Lælia × 'Mrs. Gratrix' (*Gard. Chron.* fig. 5; 5/1/1901).—*G. S. S.*

Lælio-Cattleya × Digbyana-Mossiæ Langwater var. By G. W. Craig (*Amer. Gard.* xxii. 317, pp. 44, 45; figs. 12, 13; 19/1/1901). —A bigeneric hybrid out of *Cattleya Mossiæ* by *Lælia Digbyana*, raised by Messrs. James Veitch, of Chelsea, in 1890, and now in the Langwater collection of Mrs. F. L. Ames, North Easton, Mass., U.S.A. *C. C. H.*

Lathyrus nervosus, Lam. Lord Anson's Pea. By James Britten (*Journ. Bot.* 459, p. 98; March 1901).—Notes on the synonymy of this and other species of Lathyrus. This Pea is *L. magellanicus* of Aiton, but not of Lamarck. It is the *L. Armitageanus*, Westc., of Sweet's "British Flower Garden."—*G. S. B.*

Lettuce Diseases. By Profs. G. E. Stone and R. E. Smith, of the Massachusetts Experimental Station (*Amer. Gard.* xxii. 331, pp. 308, 309; 27/4/1901).—Controlled by means of partial sterilisation of the soil. *C. C. H.*

Lhotskya ericoides (*Myrtaceæ*), King George's Sound (*Bot. Mag.* tab. 7758).—A heath-like shrub with closely applied clusters of small white flowers.—*G. H.*

Lichens and Mosses (*Act. Hort. Pet.* tom. xviii. fas. iii.).—Enumeration of about 120 species found near Moscow.—*C. W. D.*

Light and Plants Grown in Rooms (*Rev. Hort. Belge*, Jan., Feb., March, 1901).—M. L. de Nobele contributes articles on this subject

He first describes the physiology of assimilation, &c., which requires certain rays, and the injurious effect by their reduction within a room; the nature of chlorophyll and its functions, especially in the formation of starch, and the hindrances to its production. He gives (in the March number) a diagram showing the relative amount of light received at different distances from a window, viz. from the window itself to 1 and 2 metres. The quantity varies from ·5 of the whole amount of light, as in the open air, to 0·079 at a distance of 2 metres.—*G. H.*

Lilacs, Persian, and Crosses. By L. Henri (*Rev. Hort.* pp. 39, 69, and 98; figs. 8, 9, 10, 20 to 25, and 31 to 33; January 1901).—With woodcuts.—*C. T. D.*

Lilium candidum Culture. Anon. (*Gard. Mag.* 2472, p. 162; 16/3/1901).—An instructive note on the treatment of this capricious Lily. The note emphasises the importance of planting the bulbs immediately they are lifted, the time for which is not stated. The accompanying illustration represents an exceptionally fine group of flowering plants of this Lily, two years planted, in Mrs. Kingsley's garden at Bourne Orchard, Hertford. She states that she finds dry bulbs are slow in becoming established and liable to become diseased. She obtains clumps of bulbs from cottage gardens and replants at once, and each autumn applies a dressing of road sand and short manure to the bed.—*W. G.*

Lilium Humboldti. By E. H. (*Journ. Hort.* 2735, p. 176; 28/2/1901; fig.).—Dealing with the cultivation of this attractive Lily, and showing that it is not difficult to manage when established, but certainly not an easy one to establish.—*W. W.*

Lilium Kelloggii (*Garden*, p. 331; 11/5/1901; fig.) A native of California, discovered by H. N. Bolander; named after Dr. Albert Kellogg, a Californian botanist.—*H. J. C.*

Lilium kewense (*L. Brownii chloraster* × *L. Henryi*) (*Gard. Chron.* p. 110, and plate; 16/2/1901).—The cross was made in July 1897, and the hybrid flowered in July 1900.—*G. S. S.*

Linaria vulgaris, Beobachtungen und Culturversuche über eine Blüthen-anomalie. By Anton J. M. Garjeanne. (*Flora*, 1891, Pt. 1, p. 77, figs. ix., x. diagrammatic curves.)—The anomaly was the presence of cata-corollar lobes in varying numbers present in 10 per cent. of a culture made in '98, the flowers often distinguishable by the presence of an exceptionally large axillant bract. The anatomical structure of these lobes is almost the same as the petals; the histogeny is the same. On raising seed from flowers already set at the beginning of the observations, only 3·7 per cent. (out of 8,028 flowers) showed the anomaly. The results of crosses between flowers with the same or different numbers of extra lobes showed that the intensity of the anomaly in the offspring depends more on that of the male parent than on the female. The numbers 1 and 3 are commoner than 2, 4, 5 for the extra lobes. They appear especially

strong on well-nourished plants, and appear to arise from external conditions, though transmitted by heredity.—*M. H.*

Liparis tricallosa (*Gard. Chron.* p. 225; fig. 85; 6/4/1901).—Described and figured.—*G. S. S.*

Lithothamnia of the Museum d'Histoire Naturelle, Paris. By F. Heydrich (*Engl. Bot. Jahrb.* xxviii. pp. 529–545, t. xi.; 11/1/1901).—A systematic account of the Algæ of this group, preserved in the Paris Museum, with descriptions of numerous new forms.—*A. B. R.*

Lobelia tenuior (*Gard. Chron.* p. 46; fig. 26; 19/1/1901).—Described and figured.—*G. S. S.*

Lonicera pyrenaica (*Caprifoliaceæ*), Pyrenees (*Bot. Mag.* tab. 7774).—This has been in cultivation since 1798. It forms a small shrub in the Rock Garden, Kew. It has small, narrow obovate leaves and pairs of white or pale-rose coloured flowers, $\frac{3}{4}$ in. in length, with a regular border.—*G. H.*

Lythrum rivulare, Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 461, p. 172; May 1901).—Description of a new species, from Report of Natal Botanic Gardens for 1900.—*G. S. B.*

Magnolias. By W. J. Bean (*Gard. Mag.* 2478, p. 180; 23/3/1901).—A full descriptive account of all species and varieties of Magnolias in cultivation, with illustrations of *M. stellata*, *M. conspicua*, and variety *Soulangeana*. A valuable account for reference to all interested in these beautiful trees and shrubs.—*W. G.*

Malaxideen, Zur Biologie der. By K. Goebel (*Flora*, 1891, Pt. 1, p. 94).—This deals with the European genera Microstylis, Malaxis, and Sturmia only. As Irmisch showed, the bulbs are true pseudo-bulbs of shoot origin exclusively, unlike those of Ophrydeæ. Irmisch erred in ascribing a velamen to the roots. The mature pseudo-bulb is, however, surrounded by a loose sheath formed of the bases of the sheathing leaves. The cells of this sheath have a ligneous thickening, spiral in Malaxis (velamen fashion), reticulate in Microstylis and Sturmia, the cell-wall often being perforated, and in all respects adapted to absorb water; similar reticulate cells occur in the stems. The morphology of the successive shoots and their leaves is elucidated. Root-hairs, or rhizoids, are given off from the back of the lower leaves, a condition rarely present [or at least described] in flowering plants. The presence of a symbiotic fungus in the axis outside the central cylinder is described, less abundantly developed in the leaves and roots. The whole structure is specially adapted to allow the plant, with a scanty root system, to draw to the largest extent on the soil for mineral constituents.—*M. H.*

Malvaceæ, Experiments in Crossing the various Genera of this Order. By H. Lindemuth (*Gartenflora*, p. 8; 1/1/1901).—*Abutilon Thompsoni* crossed with two named varieties of Malva gave

noteworthy results in ornamental foliage. *Lavatera arborea* crossed with *Abutilon Thompsoni* gave yellow foliage to the first-named. Noteworthy results also followed the crossing of *A. Thompsoni* and *Malva capense*, Greke.—*C. E. S.*

Manettia bicolor (*Rubiaceæ*), Brazil (*Bot. Mag.* tab. 7776).—This is a well-known stove climber, first imported by Mr. J. Veitch, sen., of Exeter, sixty years ago. It is never out of flower at Kew. It is a slender climber with ovate, pointed leaves 2 in. long. The flowers are tetramerous, with reflexed sepals and a tubular corolla, inflated at the base, 1 in. long, covered with crimson hairs from the base to the golden limb.—*G. H.*

Manures, Nitrogenous (*Ann. Ag.* p. 65; 25/2/1901).—Experiments on the cultivation of leguminous plants, particularly in the application of nitrogenous manure.—*C. H. H.*

Manuring Fruit Trees. By A. Petts (*Journ. Hort.* 2785, p. 170; 28/2/1901).—These articles deal with the value of certain manures for supplying nitrogen to the soil, also with the times when it should be applied, and when not. Also of phosphorus and the particular manures conveying it; of potash; and of liquid manures.—*W. W.*

Market Gardeners' Compensation. Anon (*Gard. Mag.* 2482, p. 315; 25/5/1901).—Comment upon two recent cases brought before the Law Courts in connection with the leases of market garden tenants, chiefly with regard to compensation for "improvements," and the removal of glasshouses and other fixtures, as well as the felling and removing of orchard trees.—*W. G.*

Masdevallia deorsum (*Orchideæ*), New Grenada (*Bot. Mag.* tab. 7766).—It has the singular habit of being pendulous, and bears yellow flowers, spotted and striped with crimson, being 6 in. from apex to apex of the perianth tips.—*G. H.*

Melilotus, Monograph of the Genus. By O. E. Schulz (*Engl. Bot. Jahrb.* xxix. pp. 660–735, tt. vi.-viii.; 12/2/1901).—An historical and morphological account of the genus, followed by a systematic arrangement, with full descriptions of the species, of which the author recognises twenty-two, including several novelties.—*A. B. R.*

Mesembryanthemum calamiforme (*Ficoideæ*), the Karroo, S. Africa (*Bot. Mag.* tab. 7775).—Leaves are cylindrical, 2 to 3 in. long, ⅓ in. in diameter; flowers 2½ in. diameter, with very narrow innumerable petals, white with pink tips.—*G. H.*

Mignonette in Pots. By W. P. (*Gard. Chron.* p. 183; 23/3/1901).—Recommended and described as grown in "the umbrella method."

G. S. S.

Modecca senensis (*Passifloreæ*), Mozambique and Delagoa Bay (*Bot. Mag.* tab. 7763).—A unisexual plant. The pale yellow calyx of the male is tubular and slightly inflated with a reflexed twist, 1½ in. in length; the petals, &c., are entirely included.—*G. H.*

Model Gardens, German (*Die Gart.* 19, p. 217; eight figs.).—An account of the fruit nursery of Paul Huber at Halle in Saxony. *A. H. K.*

Montbretia crocosmæflora var. Germania (*Die Gart.* 14, p. 164; coloured fig.).—The result of a cross between *M. crocosma aurea imperialis* and one of the numerous Montbretia varieties in cultivation. Flowers large and richly coloured.—*A. H. K.*

Moorea irrorata. By G. Schneider (*Gard. Chron.* p. 248; figs. 94 and 95; 20/4/1901).—Described and figured.—*G. S. S.*

Moss, Fossil (*Bei. Bot. Cent.* bd. 10, ht. 3).—Herr Adalbert Geheeb records the discovery of a form of *Hypnum fluitans*, L., in a deposit of peat or clay under about 2·5 metres of loam in the neighbourhood of Fulda. *G. F. S.-E.*

Nandina domestica. By H. Dauthenay (*Rev. Hort.* p. 59; January 1901).—Japanese evergreen shrub, with red berries, stated to be quite hardy and well worth growing, though reputed tender, and hence rare.—*C. T. D.*

Neillia Torreyi (*Rosaceæ*), Rocky Mountains. (*Bot. Mag.* tab. 7758).—A shrub with small corymbs, 2 in. in diameter, of white flowers. Leaves resembling those of the Currant; from the Arboretum, Kew.—*G. H.*

New Plants in Cultivation. By M. E. Bedinghaus (*Rev. Hort. Belge*, March 1901).—The following are described: *Salvia splendens*, Gloire de Stuttgart; *S. s.* panaché, à feuille d'Aucuba; *Antirrhinum majus*, fol. aur. 'Sonnengold'; *A. m.* Soleil d'or, an improvement upon Tom Pouce; *Arctotis grandis* (stœchadifolia); *Centaurea depressa*, Roi des bluets.—*G. H.*

Nicotiana colossea variegata. With coloured plate (*Rev. Hort. Belge*, April 1901).—A most ornamental species. The leaves are oval, of a bright green with a yellow irregular border.—*G. H.*

Nomenclature of Hybrid Orchids. By H. J. Chapman (*Gard. Mag.* 2470, p. 182; 2/3/1901).—The writer pleads for a central authority for the naming of hybrid Orchids, which are now so numerous. The R.H.S. should be the naming authority, and a "stud book," or "pedigree book," of all hybrid Orchids should be kept by the Society, together with dried specimens and coloured drawings for the purpose of identification. *W. G.*

Nymphæa cærulea, Savigny. **N. scutifolia,** D. C. **N. pulcherrima** (*Amer. Gard.* xxii. 317, p. 43; fig. 10; 19/1/1901).—An excellent photograph of these three species, with a short description of the former two, which, it appears, are frequently confounded.—*C. C. H.*

Oaks of America (*Rev. Hort. Belge,* March 1901).—Observations and a plate with leaves of 20 species. They are continued in the May number, with a plate containing figures of 38 species.—*G. H.*

Ocneria dispar (*Der Schwammspinner*). By Dr. Arnold Jacobi (*Gartenflora,* p. 154; 15/3/1901).—Description of the pest and the best method of destroying same.—*C. E. S.*

Odontoglossum crispum. By A. Sandhack (*Die Gart.* 16, p. 181; two figs).—The author gives an interesting account of his experience in collecting this Orchid on the Cordilleras of Southern Colombia, especially in the Pacho district, where it has been well nigh exterminated.—*A. H. K.*

Odontoglossum crispum, 'Franz Masereel' (*Garden,* p. 329; 11/5/1901).—Fig. of this beautiful and distinct plant.—*H. J. C.*

Odontoglossum loochristyense Rochfordianum and *O. C. coundonense.* By H. J. Chapman (*Garden,* pp. 160 and 161; 9/3/1901; figs).—These natural hybrids prove that the parent species, *O. crispum* and *O. triumphans,* grow together in certain districts, instead of being, as previously supposed, divided by wide areas in their native habitats. *H. J. C.*

Onions, Fertilisers for. By J. J. Willis (*Gard. Mag.* 2474, p. 191; 30/3/1901).—Instructive note on manuring Onions, and particularly upon the relative merits of "commercial fertilisers," and what is termed natural manure. The note is worthy of attention, as are all the contributions from this well-known authority on agricultural chemistry. *W. G.*

Orchids, Seedling. By Gustav Bartsch (*Gartenflora,* p. 115; 1/3/1901).—Cultural instructions. Lælias and Cattleyas recommended as more easily yielding certain results.—*C. E. S.*

Ornithophilous Flowers. By E. Worth (*Gard. Chron.* p. 301; 11/5/1901).—An account of these flowers in Eastern Tropical Africa. *G. S. S.*

Orris-root (*Iris florentina*). Anon (*New Zealand Dept. of Agricult.* 8th Report, pp. 296–8; 1900).—A quantity of the white Florentine Iris (*I. florentina*) has been obtained through Barr & Sons, King Street, W.C., and planted at Momohaki, New Zealand, for cultivation of the Orris root. The plants were obtained from Italy, and supplied at a cost of £3 per thousand. A small quantity of the less abundant *Iris pallida,* together with an unnamed species from Austria, was also imported for the same purpose, but it seems that these latter were not so easily obtained.—*R. N.*

Pachyphytum (Echeveria) bracteosum (*Rev. Hort. Belge*, January 1901).—Ad. Van den Heede describes his method of multiplying this plant. In June 1900 he had only five small plants. He cut them down below the leaves, leaving the base in the ground to grow; the leaves were carefully cut off and the crown replaced in the soil. The leaves were then placed in leaf-mould and sand, being buried to the depth of a centimetre (⅜ in.). In August young plantlets began to appear. In September they were abundant, so that in November he had 200. In a particular experiment one leaf was inserted by the base, a second by the tip, and a third buried entirely, only a piece of the stem being exposed. He found the two latter were the quickest in giving rise to young plants. *G. H.*

Panax Balfourii (*Rev. Hort. Belge*, April 1901).—This plant is described by M. Ch. Pynaert as of recent introduction, with an illustration, showing variegated foliage, valuable for garden ornamentation. The leaves are dark green spotted with cream and bordered with pure white. It is very compact in form. It was introduced from New Caledonia by Messrs. Sander.—*G. H.*

Pandanus Sanderi (*Amer. Gard.* xxii. 325, pp. 188, 189, fig. 44; 16/3/1901).—A new Pandanus with golden yellow and green foliage. *C. C. H.*

Park Victoria, Berlin. By Karl Schneider (*Die Gart.* 24, p. 277, and 25, p. 294).—This superb example of German landscape gardening fully described and illustrated by nine figs.—*A. H. K.*

Passiflora quadrangularis, 'The Granadilla.' By W. W. (*Garden* p. 6; 5/1/1901; fig.).—Giving also particulars of other edible kinds. See also 12/1/1901; p. 23.—*H. J. C.*

Peach Leaf Curl, its Nature and Treatment. By Newton B. Pierce (*U.S. Dep. Agric., Div. of Veg. Phy. and Path.*; 30 plates and 10 figures. Washington, 1900).—A valuable report extending to 204 pages and abundantly illustrated. The nature of the disease, the history of its treatment by previous workers, and the plan of preventive spray work conducted by the Department occupy the first four chapters. The next two chapters deal with the influence of spraying upon the foliage and fruit of the trees; while chapters viii. and ix. give a full account of the preparation, composition and general character of the spray used, and methods of application. Chapter ii., in which the fungus causing the disease (*Exoascus deformans*) is fully described and illustrated, will be of particular interest to botanists.—*D. H.*

Pear, 'New' (*Bartlett* × *Winter Nélis*) (*Amer. Gard.* xxii. 323, p. 150, fig. 38; 2/3/1901).—Raised by Mr. H. M. Hartshorn, of Malden, Mass., and exhibited before the East New York Hort. Soc. This pear appears to combine the good qualities of both parents, inheriting the large size, thin skin, free growing and bearing qualities of 'Bartlett'

together with the fine flavour, smooth texture, juiciness and late keeping qualities of 'Winter Nélis.'—*C. C. H.*

Pears, Early, and their Culture. By C. Jokisch (*Gartenflora*, p. 62; 1/2/1901).—Varieties recommended: 'Frühe von Trevoux,' 'William's Bon Chrétien,' 'Dr. Jules Guyot,' 'Clapp's Favourite,' 'Marguerite Marillat,' 'Triomphe de Vienne,' 'Mortillet Butterbirne.' For later Autumn: 'Gute Louise von Avranches,' 'Birne von Tongres.' As a striped Pear the 'Veriensdechante Pear'; and 'Alexandrine Douillard' is strongly recommended as a Pear too little known.—*C. E. S.*

Pectines and Mucines (*Bei. Bot. Cent.* bd. 10, ht. 2, p. 122).—Herr Schröder points out the close affinity existing between vegetable pectines and animal mucin, especially as regards their reactions, solubilities, elementary analysis, &c.—*G. F. S.-E.*

Perfume, Growing Flowers for. Anon (*Agricult. Journ. Cape of Good Hope*, vol. xviii. p. 187).—Under the above heading appears an interesting article on flower growing in the South of France. The total area devoted to this industry is nearly 1,800 acres, of which Nice has 500 acres, and Cannes, Mentone, and Grasse each 250 acres. In this area there are annually treated 4,100,000 lb. of Roses, 5,500,000 lb. of Orange Blossoms, 440,000 lb. of Jasmine, 330,000 lb. of Cassia, 330,000 lb. of Tuberoses, 440,000 lb. of Violets. More than 1,000,000 lb. of pomades or perfumed oils and 1,000,000 galls. of floral waters are annually manufactured. *R. N.*

Phaius, a New. By H. J. C. (*Gard. Mag.* 2469, p. 116; 23/2/1901).—Note on a new species provisionally named *Phaius Warpuri*, introduced by M. Warpur from Madagascar. The writer discusses in a general way the system of Orchid nomenclature, and in this particular case he resents the action of the botanist in altering names that have become established in gardens. The new Phaius is now determined to be the true *P. tuberculosus* of Blume, and what was previously known in gardens as *P. tuberculosus* is now named *P. simulans*.—*W. G.*

Phaius tuberculosus (*Gard. Chron.* p. 79; figs. 31 and 32; 2/2/1901).—The true species collected in Madagascar by M. Warpur, and first named *P. Warpuri*, identified by Mr. Rolfe as the true *P. tuberculosus*.—*G. S. S.*

Phaius tuberculosus and its Hybrids. By W. H. Young (*Gard. Mag.* 2471, p. 144; 9/3/1901).—A descriptive account of the three hybrids between this species and others, with cultural notes. A figure of the true *P. tuberculosus* (*P. Warpuri*) is given.—*W. G.*

Phalænopsis (*Rev. Hort. Belge*, June 1901).—M. Ch. Chevalier contributes a paper on this genus of Orchids.—*G. H.*

Phalænopsis Denisiana (*Rev. Hort.* p. 227; January 1901).—New Phillipine species.—*C. T. D.*

Phenological Observations made at Coimbra in 1900. By A. F. Moller (*Bol. Soc. Brot.* xvii. p. 196, 1901).—These observations should prove of interest for comparative purposes. The headings are "First Leaves," "First Flowers," "First Ripe Fruit," "First Yellowing of Leaves."—*G. M.*

Phlox 'Comtesse de Jarnac.' By J. Rudolph (*Rev. Hort.* p. 30; January 1901).—A variegated form of *Phlox decussata*; leaves broadly margined with white, green centre, sometimes all white; flowers rosy-pink, but inferior; recommended for bedding; hardy and perennial; stands hot sun; indifferent to soil; prefers exposed positions.—*C. T. D.*

Phœnix Roebelenii, O'Brien. With photograph (*Rev. Hort. Belge,* June 1901).—A pinnate-leaved dwarf palm of much elegance. Its native country does not appear to be known, but possibly Indo-China. The method of cultivation is given.—*G. H.*

Phylloxera. Anon (*New Zealand Dept. of Agricult.,* 8th Report, p. 305; two figs.; 1900).—Vines on 100 properties in the Provinces of Wellington and Auckland are reported as infested with this pest. In some cases where the Vines were past recovery they were destroyed; when not so severely attacked they were treated with carbon bisulphide, the whole expense being borne by the Department. Photographs of the first winged forms of the insect found in New Zealand are given.—*R. N.*

Placea, the Genus. By Wilhelm Miller, of Ithaca, N.Y. (*Amer. Gard.* xxii. 326, pp. 210-212, fig. 48; 23/3/1901).—A discussion on the relationship of this South American genus to Hippeastrum and Narcissus.
C. C. H.

Plane, Offensiveness of. "Anon" (*Bull. d. R. Soc. Tosc. Ort.* 2, p. 53, February 1901).—People living near Plane-trees, those engaged in pruning them, and boys who play with the freshly-severed branches, have suffered considerable inconvenience from irritation in nose, eyes, and throat caused by a dust which is formed by the stellate hairs of the lower surface of the leaves. But the annoyance, which prevails during the vegetative period of the tree, is also due to a parasite, a mite, *Tetranychus telarius var. russeolus,* Koch, which is capable of living on man as well as on plants. This insect, during winter, is concealed beneath the bark of the trunk and branches, but as soon as the buds begin to burst, emigrates into the leaves, where it lives for seven months. In Paris the mites of the Plane-tree only remain about three or four months in the leaves before returning to the stems, as the former soon become coriaceous; and also never attack man, but are confined to a vegetable diet.—*W. C. W.*

Plantæ Lehmannianæ præsertim in Columbia et Ecuador collectæ additis quibusdam ab aliis collectoribus ex iisdem regionibus allatis determinatæ et descriptæ. Compositæ II. By G. Hieronymus (*Engl. Bot. Jahrb.* xxviii. pp. 558-659;

11/1/1901). — A systematic paper; includes a large proportion of novelties.—*A. B. R.*

Plantæ novæ Americanæ imprimis Glaziovianæ. III. Edit. I. Urban (*Engl. Bot. Jahrb.* xxx. Beibl. 67, pp. 27–88; 12/8/1901).—Contains a description of new species in the following orders: Guttiferæ, by W. Ruhland; Proteaceæ, Saxifragaceæ, Rutaceæ, Apocynaceæ, and Asclepiadaceæ, by K. Schumann; Meliaceæ, by H. Harms; and Amarantaceæ, by G. Lopriore.—*A. B. R.*

Plant Diseases: White Mould of Radish (*Cystopus candidus*), **and Notes upon Grape Mildew, &c.** By B. D. Halstead (*New Jersey Agri. Exp. St. Rept.*; two plates; Oct. 1900).—Interesting notes are also given on the spread of "rust" and the relation of same to weather.—*D. H.*

Plant Distribution in Southern California (*Bei. Bot. Cent.* bd. 10, ht. 3, p. 166).—A very interesting sketch, illustrated by six photos and a sketch map, of the plant distribution in Orange County, California. Prof. R. E. B. McKenney describes the following formations: 1. Mountain formation.—This consists of closely grown scrub from 6 to 9 ft. in height; it is formed by species of Arctostaphylos, Quercus, Pentstemon, &c. In patches in the dense scrub occur such plants as *Clarkia pulchella*, Pursh., and *Eschscholtzia californica*, Cham. There are many climbers, chiefly two species of Vicia. 2. Foot hills.—Also a scrub, but the plants are not nearly so close, and generally only from 18 in. to 6 ft. in height. Sometimes the hillsides are covered with Cactus. In the open patches between the shrubs there is a rich herbaceous vegetation which shows three distinct sets of plants. The first set flowers in January, and consists of Nemophila spp. and Gilia, &c.; the second begins in March, and consists of Salvia spp., Phacelia, &c., and especially *Cuscuta subinclusa*, which is especially abundant; the third, in April and in early May, consists of Allium sp., Cotyledon spp., &c. 3. Cañon formation.—Groves of trees (*Platanus racemosus* and *Quercus agrifolius*) occur in the more sheltered places, and a rich shrubby and herbaceous flora accompanies them (*e.g. Claytonia perfoliata, Phacelia Whitlavia, Mimulus luteus*, and *Galium Aparine*). 4. River-bed formation.—Shrubs about 7 ft. high, chiefly Salix spp. and *Baccharis viminea*. There are very few herbs in this region. 5. Mesa formation.—The slightly elevated and comparatively level plain between the eastern and western chains "is characterised by an absence of all arborescent and shrubby growth." It consists of succulent herbaceous plants, and hard, dry, very often spinose forms (Suæda, Atriplex, Centaurea, &c.). 6. Bog formation.—Bulrushes, Watercress, a variety of *Scirpus lacustris* and *Azolla filiculoides* are found in this, as well as *Apium graveolens* and *Cotula coronopifolia*. 7. Strand formation.—Generally herbaceous, but with a few low and spreading woody plants. The vegetation is shown to depend on the water supply and the ground. The annual rainfall is only from 12·28 to 31·87 at Los Angeles, and this small rainfall and the alkaline nature of the soil explains the "semi-desert" condition of most of the county.—*G. F. S.-E.*

Plant Life on the Steppes of South-East Russia (*Bei. Bot. Cent.* bd. 10, ht. 3).—Dr. Taliew gives some interesting details on various plants. The Chicory is abundant, and the blue flowers open with great rapidity between 5 and 8 A.M. About two or three hours later every head has closed up and remains shut during the day. The same plant is said to open its flowers at 4–5 A.M. at Upsala, and at 6–7 A.M. at Innsbruck. *Xeranthemum annuum* also opens very early in the morning; the filaments and style develop in such a way that the anther tube stands above the level of the capitulum. As soon as the sun's rays in the early morning strike the flowers, the filaments contract, dragging down the anther tube and exposing the pollen-covered style. The heads of this flower always turn towards the East through a special curvature of the stalk, so that the light falls directly upon the capitulum.—*G. F. S.-E.*

Plants, Observations on Free-growing and Transplanted. By Franz Krasan (*Engl. Bot. Jahrb.* xxviii. pp. 546–557; 11/1/1901).—A continuation of researches on the polymorphy of plants, published in an early number of the same volume (pp. 180–215). An account of the variations shown by some common plants (such as *Capsella Bursa-pastoris*, *Knautia arvensis*, species of *Viola*) when growing under various conditions of soil, either naturally or after transplanting. The author maintains that such variations are latent in the seed, the environment (nature of the soil, &c.) having merely a secondary, so to speak, directing effect.—*A. B. R.*

Platycerium (*Rev. Hort. Belge*, February 1901).—M. Louis Gentil describes species of this genus as clothing the trunks of trees on the Congo, and always growing in light. It is a mistake to grow them under shade. They affect leguminous trees with hard wood, the natives observing that a tree with this fern "will not fall."—*G. H.*

Pleroma elegans (*Rev. Hort. Belge*, March 1901).—M. J. Burvenich describes this beautiful plant of the order *Melastomaceæ*, first introduced by Messrs. Veitch in 1841.—*G. H.*

Pleurothallis Roezlii. By Otto Froebel (*Gartenflora*, p. 271; 15/5/1901.)—Received from New Grenada; a very difficult variety to import. Is a free bloomer and of easy culture. The variety is strongly recommended. Illustration from photograph.—*C. E. S.*

Plumbago capensis (*Rev. Hort. Belge*, June 1901).—M. Eug. de Duren discusses the cultivation of this plant.—*G. H.*

Plums, Drying. Anon (*Gard. Mag.* 2467, p. 84; 9/2/1901).—Abstract of the Report by the British Consul at Bordeaux on the preparation of French Plums, particularly in the plum-growing district of Lot-et-Garonne, the department which is the centre of the trade. The Consul gives a detailed account of the varieties grown for the production of Prunes, their cultivation, and details of the drying process.—*W. G.*

Pollination in Orchards. By S. W. Fletcher (*Cornell Univ. Agric. Exp. St. Bull.* 181; twenty-one illustrations).—The Bulletin is divided into two parts, the first dealing with the incidental or occasional causes of loss of fruit; and the second, and more important, with self-sterility in fruit trees. It is suggested (amongst other things) that in planting new orchards varieties should be mixed; that in the case of old and sterile orchards it might prove profitable to put a few grafts of another variety in each tree, and that while fruit trees should be well fed, yet over-stimulation is apt to produce an over-vigorous growth of vegetative shoots.
D. H.

Pollination of Vicia pannonica, M. B., and **V. striata,** M. B. (*Bei. Bot. Cent.* bd. 10, ht. 3, p. 139).—Dr. Taliew describes a peculiar arrangement of the carina in these Vetches adapted to withdraw pollen gradually.—*G. F. S.-E.*

Port Royal Mountains, Jamaica (*Garden*, p. 223; 30/3/1901. By W. J.).—An interesting article on plants peculiar to special times of the year. -*H. J. C.*

Portugal, the Botanical Regions of. By A. Moller (*Bol. Soc. Brot.* xvii. p. 97, 1901).—An excellent sketch of the principal features of the flora of the various botanical regions present in Portugal; indicating also the relations of the Spanish-Portuguese flora with that of neighbouring countries. Abridged from Willkomm's "Grundzüge der Pflanzenverbreitung auf der iberischen Halbinsel."—*G. M.*

Potash, Muriate of, as Manure. By J. J. Willis (*Gard. Mag.* 2470, p. 128; 2/3/1901).—Note describing the nature of this artificial manure, and its action upon organic and inorganic matter in garden soils.—*W. G.*

Potatos, Manuring. Anon. (*Gard. Mag.* 2468, p. 101; 16/2/1901).—Abstract of results of experiments in manuring potatos with various kinds of artificial manures carried out at five stations in Yorkshire. Mr. J. H. Burton, B.Sc., of the Yorkshire College, has read a paper on the subject before a meeting of agriculturists at Stamford Bridge.—*W. G.*

Potato Sets, "Greening." By A. Gant (*Gard. Chron.* p. 18; 12/1/1901).—A short article arguing against there being any utility in the common practice of "greening."—*G. S. S.*

Potato Tubers. Supposed Fungoid Origin of (*Gard. Chron.* p. 300; 11/5/1901).—Discussion of M. Noel Bernard's theory in a leading article.—*G. S. S.*

Primula megaseæfolia. Anon. (*Gard. Mag.* 2480, p. 287; 11/5/1901).—A descriptive note with illustration of this rare and beautiful

Primrose from the mountains of Lazistan, at an altitude of nearly 1,000 feet. Though discovered nearly half a century ago it is still one of the rarest species in cultivation.—*W. G.*

Primula obconica. Anon. (*Gard. Mag.* 2465, p. 51; 26/1/1901).—An account of the efforts made by cultivators in the improvement of this Primrose from Central China, and a record of the futile attempts at hybridising the species with others by Mr. Shea. *W. G.*

Primulas, Hardy. By H. Correvon (*Rev. Hort.* p. 242; January 1901).—Classification of and culture.—*C. T. D.*

Proliferous Leaves. By C. de Candolle (*Gard. Chron.* p. 319; figs. 17–20; 8/5/1901).—An account of these leaves, with figures. *G. S. S.*

Protarum, a New and Interesting Genus of Araceæ from the Seychelles. By A. Engler (*Engl. Bot. Jahrb.* xxx. Beibl. 67, p. 42; 12/3/1901).—"A valuable addition to the ancient endemic genera, which are proof of the great age of these islands, . . . a prototype of the sub-family Aroideæ, which still retains traces of a primitive hermaphrodite character."—*A. B. R.*

Pruning of Hardy Trees and Shrubs. By W. Dallimore (*Jour. of Hort.* 2737, p. 218; 14/3/1901).—Shows the necessity and method of pruning, also the means to be taken in order to prevent fungoid diseases entering the wound.—*W. W.*

Prunus mumé. Anon. (*Gard. Chron.* p. 183; fig. 71; 23/3/1901).—A short account of.—*G. S. S.*

Pteris Hybrids (*Rev. Hort. Belge*, January 1901).—After referring to *P. serrulata* as originating many forms, *P. cretica*, a cross from the preceding, is described as being equally remarkable for giving rise to numerous variations, which are given in detail. They are all very strong growing and much appreciated commercially.—*G. H.*

Pyrus alnifolia (*Rosaceæ*), Japan and China (*Bot. Mag.* tab. 7773).—A small tree flowering in the Arboretum, Kew. Leaves 2 to 3 in. long, acuminate, doubly serrate, with deeply immersed veins. The corymbs, 2 to 3 in. across, have white flowers.—*G. H.*

Pyrus tianschanica (*Rosaceæ*), Central Asia (*Bot. Mag.* tab. 7755).—Represents the Mountain Ash; a small tree with white flowers and bright red fruit. Growing in the Arboretum, Kew.—*G. H.*

Pyrus tianschanica. By W. J. Bean (*Gard. Mag.* 2468, p. 92; 16/2/1901).—A newly introduced species of the Sorbus or Mountain Ash group, and was flowered for the first time by Mr. T. Smith, of Newry, in 1899. It is of similar growth to the common Mountain Ash and bears

clusters of bright red berries in autumn, but is much dwarfer and slower in growth, and may be classed as a shrub. A native of the Thian Shan Mountains in Central Asia.—*W. G.*

Ragged Robin Flowers (*Bei. Bot. Cent.* abt. ii. bd. 10, ht 3, p. 51).—Herr Anton J. R. Garjeanne records a second blooming of *Lychnis Flos-cuculi* in or near Amsterdam in October. Both protandrous, homogamous, and proterogynous flowers were observed.—*G. F. S.-E.*

Reproduction in Relation to Problems in Hybridisation. By Oakes Ames (*Amer. Gard.* xxii. 822, pp. 130, 131, fig. 33; 23/2/1901).—Notes and diagrams on recent researches in the inner processes of reproduction, having special regard to the phenomena of parthenogenesis in plants.—*C. C. H.*

Rhea- or Ramie-Plant, On the Cultivation of the (*Boehmeria nivea*, Hook. & Arn.). Anon. (*New Zealand Dept. of Agricult.* 8th Report, pp. 292, 293; 1900).—*Boehmeria nivea*, *B. tenacissima* have again been distributed in New Zealand in large quantities, with a view to cultivating them for the use of the fibre. Information is given as to habitat, various methods of cultivation, cutting, gathering, stripping and baling.—*R. N.*

Rosa Fedtschenkoana (*Rosaceæ*), Turkestan (*Bot. Mag.* tab. 7770).—This has white flowers, 2 in. in diameter, and scarlet hips. It is a free growing, very glaucus shrub.—*G. H.*

Rosa Seraphini (*Rosaceæ*), Italy (*Bot. Mag.* tab. 7761).—This has a dwarf, much-branching habit, with red flowers.—*G. H.*

Rosa Wichuraiana rubra. By E. André (*Rev. Hort.* p. 20; coloured plate; January 1901).—*R. Wichuraiana* × 'Crimson Rambler.' A single pink rose climber.—*C. T. D.*

Rose Hedges in Meadows. By Alger Petts (*Gard. Mag.* 2462, p. 8; 5/1/1901).—An interesting account as to how the hedges of a home-meadow have been made attractive and interesting by budding garden varieties of Roses, Penzance and Austrian briers and China Roses, upon the common brier growing wild in the hedges, and also the planting in the hedges of fruit trees, Pears, Cherries, and Plums; while in the meadow grass have been introduced some of the hardiest of garden bulbs, such as *Colchicum autumnale*, *Fritillaria Meleagris*, and wild Hyacinths and Primroses on the banks.—*W. G.*

Rose, 'Ivory' (*Amer. Gard.* xxii. 828, p. 247; fig. 54; 6/4/1901).—A new Tea Rose, a white sport from 'Golden Gate,' originating with Mr. B. Durfee, Washington, D.C.—*C. C. H.*

Rose, New Hybrid (*Amer. Gard.* xxii. 827, pp. 227, 228; fig. 52; 30/3/1901).—Raised by Mr. Jackson Dawson at the Arnold Arboretum

Boston, Mass., from *Rosa multiflora* × the old H.P. Rose, 'Gen. Jacqueminot.' The flowers are borne in clusters, colour pale rose pink.—*C.C.H.*

Rose, 'Robert Scott' (*Amer. Gard.* xxii. 825, p. 186, with supp. fig.; 16/3/1901).—Raised by Mr. A. Scott, of Sharon Hill, Pa., from 'Merveille de Lyon' × 'Belle Siebrecht'; it inherits the habit and form of the former, together with the colour of the latter.—*C. C. H.*

Roses (*Rev. Hort. Belge*, February 1901).—Species are described as being of interest as furnishing cultural forms by crossing, &c., such as *Rosa Watsoniana* and *R. Wichuraiana*, as well as the following: Albéric Barbier (*R. Wich.* × Tea, Shirley Hibbert), René André (*R. Wich.* × Noisette, l'Idéale), Wick. rubra (*R. Wich.* × Crimson Rambler), Jersey Beauty (*R. Wich.* × Perle des Jardins); all fine climbers.—*G. H.*

Roses, Cluster and Single (*Garden*, p. 163; 9/3/1901; fig. of Rose félicite-perpétuelle). By Rosarian.—A useful list.—*H. J. C.*

Roses, Crossing or Hybridising. By S. Mottet (*Rev. Hort.* p. 67; January 1901).—*C. T. D.*

Roses in Ceylon (*Garden*, p. 258; 13/4/1901; fig.) By a Ceylon Rosarian.—Particulars of varieties suitable for, and mode of treatment at, an elevation of 5,400 feet above sea-level.—*H. J. C.*

Roses, New Foreign. By H. H. D. (*Gard. Mag.* 2473, p. 179; 23/3/1901).—A descriptive list of new Roses raised and distributed by foreign Rose growers (French chiefly). The writer being a well-known veteran rosarian, this list is of special value. It is continued in the two following numbers.—*W. G.*

Roses, New, in America. Anon. (*Gard. Mag.* 2477, p. 245; 20/4/1901).—Comments on new Roses made by Mr. E. G. Hill, before the New York Florists' Club. The critical notes are interesting, as showing the standpoint from which new Roses are viewed by our American friends, who judge Roses chiefly in regard to their suitability for forcing into flower during winter and spring, a phase of culture which they thoroughly understand and practise.—*W. G.*

Roses, their Hybrid Origin. By Leonard Barron (*Amer. Gard.* xxii. 315, p. 5; 5/1/1901).—Prof. Allard, of Angers, recently reported the results of his experiments with seedlings of Harisson's Yellow Rose, and he concludes from these that this variety is a hybrid between *Rosa lutea* and *R. pimpinellifolia.*—*C. C. H.*

Rudbeckias. By C. Wolley-Dod (*Gard. Mag.* 2471, p. 142; 9/3/1901).—A review of the cultivated species of Rudbeckia, with descriptive and cultural notes and references to illustrations of the species. The review is valuable, as it is done in the same thorough way that characterises the contributions from this writer. A woodcut is given of *R. laciniata* var. Autumn Glory.—*W. G.*

Rusts of Horticultural Plants. By B. D. Halstead (*Trans. Mass. Hort. Soc.*; two plates; 1900).—A short history of the subject is given, after which the rust diseases of particular plants, including Asparagus, Hollyhock, Carnation, Chrysanthemum, are described. The importance of selecting rust-resisting varieties, and of observing certain necessary rules when inroads of attacking fungi are expected, are emphasised by the author.—*D. H.*

Rutherglen Bug (*Nysius vinitor*) (*Agr. Gaz. N.S. Wales*, Vol. xii. Part 2, p. 247; February 1901).—This pest had attacked a Cherry crop. The infested trees were so thickly covered that, on lifting a branch, one could hardly see the cherries, which were not only pricked all over and withered, but also covered with excrement. Experiments with cyanide and other acids are given which proved effectual in destroying the whole of the bugs. Further notes are given on p. 310 *re* this pest by W. J. Allen. The following fruits they appear to especially fancy: Peaches, Apricots, Cherries, Grapes, and Raspberries. The fruit is rendered practically valueless for drying, canning, or jam-making. Not only does the bug puncture the fruit and extract the juice, but it leaves its excreta behind, which makes the fruit repulsive in appearance.—*A. W. S.*

Salsify and Scorzonera, Cookery of. By H. Roberts (*Gard. Mag.* 2481, p. 308; 18/5/1901).—Various recipes for cooking Seakale, Scorzonera and Salsify. The cooking of the last two vegetables being little understood by ordinary cooks, the recipes for preparing them for the table may be useful.—*W. G.*

Salvia splendens, 15 varieties of (*Rev. Hort.* p. 91; January 1901).—*C. T. D.*

San José Scale Investigations. I. By V. H. Lowe and P. J. Parrott (*New York Agri. Exp. St. Bull.* 193; five plates (one coloured); Dec. 1900).—The present publication deals with the development of the female insect, which was found to pass through three well-defined periods: 1. Active period; 2. Period of growth (destructive stage), when it attaches itself by its mouth to the food tissue; 3. Reproductive period. *D. H.*

San José Scale, Pure Kerosene for (*Agr. Gaz. N.S. Wales*, Vol. xii. Part 2, p. 286; February 1901).—A brief article showing that pure kerosene has proved very effective, when applied carefully with a brush, in destroying San José Scale on deciduous fruit trees. One expert writes that he painted eighteen 'Carrington' and four 'Nelson' Apple trees which were badly affected with this pest, and that at the time of writing there was not a scale to be seen on any of them. The only really effectual means of destruction is to attack the scale insects in winter while the trees are bare of leaves, and after pruning. The kerosene method is exceedingly simple and efficacious.—*A. W. S.*

Sarcochilus lilacinus (*Orchideæ*), Malayan Peninsula (*Bot. Mag.* tab. 7754).—It bears pale lilac flowers, 1½ in. across.—*G. H.*

Sea-Thrifts and Sea-Lavenders. By G. C. Druce (*Journ. Linn. Soc.* p. 66; April 1901).—The characters and distribution of the various species are discussed, also the nomenclature. The author suggests the propriety, from a priority point of view, in giving the generic name of Statice to the Thrifts, and Limonium to the Sea-Lavenders.—*G. S. S.*

Seeds, Disease in. By G. Massee (*Gard. Chron.* p. 184; 23/3/1901).—Caused by fungi.—*G. S. S.*

Seeds, Guaranteed Percentage (*Rev. Hort. Belge*, Jan. 1901).—M. Jules Burvenich shows that the usual basis is untrustworthy. The common practice is to sow 100 seeds and to give the percentage of seedlings as that "guaranteed" to buyers. In sowing 2,000 seeds of stock (*Matthiola annua*), in lots of 100, the percentages varied from 45 to 92. The mean of the first *ten* lots was 72, while the mean of the second was 73; so that the true percentage can only be guaranteed from such an extensive experiment as the above.—*G. H.*

Selenipedium × Umbriel. By Oakes Ames (*Amer. Gard.* xxii. 333, p. 350; 11/5/1901).—A new secondary hybrid between *S. Sargentianum* and *S.* × *grande*.—*C. C. H.*

Selenipedium × Urgandæ Greyi. By Oakes Ames (*Amer. Gard.* xxii. 325, p. 192, fig. 46; 16/3/1901).—Raised by Mr. R. M. Grey, of North Easton, Mass., from *S. Lindleyanum* and *S. longifolium magniflorum*.—*C. C. H.*

Senecio Petasites, Dc. *Compositæ*, Mexico (*Rev. Hort. Belge*, Jan. 1901).—After some remarks on the differences in the classification of this order by German, English, and French botanists, the author notes that the old term *Senecio* now includes some ten distinct genera. It was described in *Bot. Mag.* vol. xxxvii. 1st ser., pl. 1536, when it first flowered in Europe (1812) in Mr. Lambert's garden at Boyton. It is intermediate between *S. Tussilaginis* and *S. præcox*, hence its present name.—*G. H.*

Senecio tabularia (*Rev. Hort.* p. 24; fig. 2; January 1901).—A new decorative foliage plant from Mexico. Flowers inconspicuous, but foliage bold; plants 4 to 6 ft. across, with large palmate leaves; not hardy; humid soil; stands hot sunshine.—*C. T. D.*

Senecio tugelensis and **S. seminivea,** Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 461, p. 169; May 1901).—Descriptions of new species, from the Report of the Natal Botanic Gardens for 1900.—*G. S. B.*

Siberian Crab Apples. By C. Mathieu (*Gartenflora*, p. 118; 1/3/1901).—With illustrations of varieties.—*C. E. S.*

Siparuna, Monograph of the Genus. Contribution to our knowledge of Monimiaceæ. By Janet R. Perkins (*Engl. Bot. Jahrb.*

xxviii. pp. 660–705, tt. xii.–xiv.; 11/1/1901).—A systematic account of the genus, the number of species in which is brought up to eighty-nine, several new ones being here described.—*A. B. R.*

Snapdragon, New Disease of. By Prof. F. C. Stewart, of the Geneva (N.Y.) Experiment Station (*Amer. Gard.* xxii. 322, pp. 127, 129, fig. 32; 23/2/1901).—This disease is an anthracnose, caused by a fungus new to science, *Collatotrichum antirrhini*; it first appeared on Long Island, N.Y., U.S.A.—*C. C. H.*

Solanum Wendlandi. By E. André (*Rev. Hort.* pp. 116 and 218: January 1901).—Coloured plate and description with list of good species. *C. T. D.*

Sparrow Plague. By A. S. F. (*Gard. Chron.* p. 320; 18/5/1901). —*Résumé* of charges against the House Sparrow, with a verdict of guilty.—*G. S. S.*

Spiræa (*Rev. Hort. Belge*, Ap. 1901).—The varieties 'Washington' and 'Gladstone' are described, with photographs.—*G. H.*

Spraying in Bloom. A joint Report by S. A. Beach, of the N.Y Agric. Exp. St., and L. H. Bailey, of the Cornell Univ. Agric. Exp St. (*Bull.* 196 (Geneva, N.Y.); two plates and numerous illustrations). —An account of laboratory and field experiments. It was found that highly diluted Bordeaux Mixture was fatal to the germination of pollen grains: even 2 parts in 10,000 of an aqueous sugar solution "sometimes had an adverse influence on the germination of the pollen." On the whole the evidence seemed to indicate that spraying in bloom tended to produce a thinning effect upon the crop of fruit.—*D. H.*

Stapelia nobilis (*Asclepiadeæ*), S. Africa (*Bot. Mag.* tab. 7771).— This is closely allied to *S. gigantea.* The stem is ¾ in. in diameter, four-angled. The flowers are 2 in. broad at the throat, with reflexed pointed lobes 3 in. long to the apex. The corolla is red-purple externally, the inner side being ochraceous, with blood-red cross lines.—*G. H.*

Sterculiaceæ, African. By E. G. Baker (*Journ. Bot.* 460, p. 122; April 1901).—Descriptions of several new species of Melhania, Dombeya, and Hermannia.—*G. S. B.*

Sternbergias. By C. Wolley Dod. (*Gard. Mag.* 2465, p. 47; 26/1/1901).—A concise review of the genus Sternbergia, including the synonymy of species, together with interesting historical notes, with an illustration of *S. macrantha*, also a short cultural note.—*W. G.*

Strathmore Weed (*Pimelea*). Anon. (*N. Z. Dep. Agri.* 8th Rep., p. 311; fig.; 1900).—The toxic properties of *Pimelea Lyallii* and *P. prostrata* are reported as having caused the death of two horses. A number of instances have also been reported of poisoning by Pimelea in

Australia. Eighty-two grains of alcoholic extract was found sufficient to destroy a guinea-pig.—*R. N.*

Timber-growing and Climate. By J. Simpson (*Gard. Chron.* p. 101; 16/2/1901).—Written to dispel the idea that our soil and climate are in any way antagonistic to timber-growing.—*G. S. S.*

Tomato Houses. By H. W. Ward (*Gard. Chron.* p. 79; 2/2/1901).—Full and detailed instructions for building.—*G. S. S.*

Trees at Les Barres. By R. (*Garden*, p. 370; 25/5/1901; fig. of Pine Forest).—Particulars as to the development of the estate by the late M. Pierre de Vilmorin and the various experiments tried. The formation of the French Government School of Forestry and some facilities given to the pupils are also touched upon.—*H. J. C.*

Tropical Fruits. By W. J. (*Garden*, p. 5; 5/1/1901).—A most interesting article, dealing with the various kinds of Tropical fruits, particularly those of Jamaica.—*H. J. C.*

Tulipa Gesneriana, Beiträge zur Kenntniss der Entwicklung des Embryosackes und des Embryo (Polyembryonie). By Ernst Alfred (*Flora*, 1891, Pt. 1, p. 37, figs. iv.-viii.).—The eight nuclei of the embryo-sac are formed in the normal way, by three consecutive mitotic divisions, and the three uppermost constitute a normal egg apparatus. The conflicting statements of Treub and Mellink are explained by the study of embryo-sacs which through cultivation have developed irregularly. Cells at the chalaza and the base of the nucellus, of special character, probably form a connecting link for nutrition, and render unnecessary the antipodal cells, which abort. In fertilisation the scheme of Nawaschin is realised, one male nucleus fusing with the oosphere, the other joining the two hitherto separate polar nuclei to form the endosperm-nucleus. The poly-embryony is due to branching of the young embryo—the so-called pro-embryo. This is paralleled by cases recorded in *Erythronium*. A most useful *catalogue raisonnée* of all the recorded cases of poly-embryony closes the paper.—*M. H.*

Tulipa Wilsoniana (*Gard. Chron.* p. 332; fig. 121; 26/5/1901).—Imported by M. Van Tubergen. It has brilliant blood-red blossoms. *G. S. S.*

Tulips. By J. Douglas (*Gard. Chron.* p. 264; 27/4/1901).—Their history, culture, &c.—*G. S. S.*

Tulips, Darwin (*Rev. Hort. Belge*, June 1901).—These were introduced about twelve years ago by Krelage. They do not degenerate as many other kinds are found to do, even after eight years. M. J. Burvenich describes his method of culture.—*G. H.*

Turnip Disease Caused by Bacteria. By W. Carruthers and

A. Lorrain Smith (*Journ. Bot.* 457, p. 38; figs.; January 1901).—The bacterium has been named *Pseudomonas destructans*.—*G. S. B.*

Tutu (*Coriaria spp.*), Pt. 1. By T. H. Easterfield (*N. Z. Dep. Agri.* 8th Rep., pp. 137–142, with two plates; 1900).—*Coriaria ruscifolia* ("tree toot") and *C. thymifolia* ("ground toot"), collectively known as the "tutu" by the Maoris, have been systematically investigated by Professor Easterfield, and found to contain a highly poisonous glucoside, for which the name "tutin" is suggested. So great is its toxic power that a full-grown cat was killed by 0·05 grain, a pig by 2 grains, and a small dose, estimated at about 0·01 grain, caused sickness and incapacity for work extending over twenty-four hours in a full-grown man. The damage done to stock by these plants is enormous; indeed, the existence of such a succulent shrub upon the coast was one of the most formidable obstacles to the stocking of New Zealand with sheep and cattle. The animals brought in by Captain Cook in both his voyages died in what to him was an unaccountable manner, but, as Lauder Lindsay has pointed out, the general description of the symptoms leaves little doubt that they died of "toot" poisoning. The distribution and economic value of the CORIARIÆ are also set forth.—*R. N.*

Umbelliferæ of Chile—A Rejoinder. By K. Reiche (*Engl. Bot. Jahrb.* xxx. Beibl. 67, pp. 21 23; 12/3/1901).—A reply to Dr. Urban's criticism on the author's paper on Chilian Umbelliferæ, chiefly relating to the supposed occurrence of *Micropleura* on the island of Chiloe.—*A. B. R.*

Remarks on the Foregoing Rejoinder. By I. Urban (*Engl. Bot. Jahrb.* xxx. Beibl. 67, pp. 24–26).—*A. B. R.*

Uredines, Biology of Certain. By Dr. Plowright (*Bull. Soc. Myc. de Fr.* xvii. Fasc. 1, 1901, p. 97).—Chiefly concerns experiments with æcidiospores of *Berberis vulgaris*, and certain grasses.—*M. C. C.*

Uredines, Nuclear Evolution, and Sexuality. By René Maire (*Bull. Soc. Myc. de Fr.* xvii. Fasc. 1, 1901, p. 88).—Extract from communication to the Botanical Congress, and published *in extenso* in the volume of "Acts of the Congress." Technical and confused, of little horticultural interest.—*M. C. C.*

Ursinia brevicaulis, Wood & Evans. By J. Medley Wood and M. S. Evans (*Journ. Bot.* 461, p. 172; May 1901).—Description of new species, from Report of Natal Botanic Gardens for 1900.—*G. S. B.*

Valeriana arizonica. By M. T. M (*Gard. Chron.* p. 198; fig. 75; 30/3/1901).—Described and figured.—*G. S. S.*

Vegetables, Early, in Algiers, for Export (*Jour. Soc. Nat. Hort. Fr.*; February 1901).—Most of the early Potatos are the English varieties. Early Peas, Tomatos, and Artichokes are the leading articles grown.—*G. P.*

Vegetables, English, in East Africa. By A. H. Cooper (*Journ. Hort.* 2727, p. 7; 3/1/1901).—Lettuce, Cauliflowers, Brussels Sprouts, Savoys, Peas, and Tomatos grew remarkably well in the cool season, viz. from April till September, 100 miles up the Zambesi River in Portuguese East Africa, and were of good flavour. Potatos were not a great success. Melons could be produced in the hot season, but required great care, and protection from the heavy rains.—*W. W.*

Vegetation Disease Act (*Agr. Gaz. N.S. Wales*, Vol. xii. Part 2, p. 312; February 1901).—Under the provisions of the above Act, the introduction into New South Wales of any plants, or portions thereof, infested by the devastating eel worm (*Tylenchus devastatrix*) is prohibited.—*A. W. S.*

Veronica glauca (*Scrophularineæ*), Greece (*Bot. Mag.* tab. 7759). —An annual bearing bright blue flowers with a white throat.—*G. H.*

Violet Disease. Anon. (*Gard. Mag.* 2463, p. 21; 12/1/1901). —Note on a leaf parasite on the Violet reported by Mr. W. Carruthers to be the fungus *Ovularia lactea*, which weakens the plant by destroying the tissue of the leaves. No remedy for the disease is suggested.—*W. G.*

Violet, Spot-Disease of the (*Alternaria violæ*, Galloway and Dorsett, n. sp.). By P. H. Dorsett (*U.S. Dept. of Agric., Div. of Veg. Phy. and Path. Bull.* 23; seven plates (one coloured); Nov. 1900).—The paper fully describes the general appearance of the disease from the early stages of infection to the fully developed period, together with an account of the author's experiments proving its fungoid nature, the conditions favouring the development and spread of the disease, and the methods of prevention.—*D. H.*

Violets, Spot-Disease of. Anon. (*Gard. Mag.* 2474, p. 197. 30/3/1901).—Report on the fungus disease which attacks the Violet in this country as well as in America, by Mr. P. H. Dorsett, of the Vegetable Physiology and Pathology Division of the United States Department of Agriculture. The reporter describes the disease in a clear way and, what is most valuable, gives suggestions of preventive measures set out in a concise way under ten separate paragraphs. The directions given should be followed by cultivators whose Violets are attacked, and the results reported.—*W. G.*

Violets, Cultivation of, for Profit. By H. W. Ward (*Gard. Chron.* p. 249; 20/4/1901).—Describing the methods of cultivation. *G. S. S.*

Wanderungen des pflanzlichen Zellkernes. By Hugo Miehe (*Flora*, 1891, Pt. 1, p. 405, fig. x.).—The nucleus responds to the irritation of a wound in neighbouring cells approaching the site thereof (traumatotropy). This reaction and the chemical functions of the nucleus play an important part in determining the healing of wounds.—*M. H.*

Washed Soils and How to Prevent and Reclaim them (*Bull. Bot. Dep. Jam.* May 1901) (*U.S. Dept. of Agri., Farmers' Bull.*, No. 20).—Four methods of arresting erosion are given: (1) Chemical means (as manures, &c., which change the texture of the soil); (2) cultivation and underdraining; (3) reforestation; (4) grass and similar vegetation. Each of these is considered in detail.—*G. H.*

Water, Conservation of Soil-Moisture and Economy in the Use of Irrigation. By E. W. Hilgard and R. H. Loughbridge (*Bull. Bot. Dep. Jam.* April 1901) (*Bull.* 121, *Agr. Exp. Stat. Univers. of California*).—The authors observe that from 300 to 500 tons of water are on the average required to produce 1 ton of dry vegetable matter. They describe the difference in the root systems of crops in the arid regions having a penetrable soil, allowing roots to descend to great depths, and the converse of the Eastern United States. They point out the importance of storing winter rains by "fall-ploughing," so rendering the superficial soil easily penetrated by rain. Hence the knowledge of the sub-soil to 4 or even to 6 or 8 feet is most important. To prevent subsequent evaporation, the surface should be mulched. The difference between this treatment and none, on "a loose, generous soil of Alameda Creek" gave as averages in tons of water per acre, from 1 to 6 ft. deep, 6·3 p.c. against 4·2, and 756 tons against 512.—*G. H.*

Water Lilies, Hybrid. By A. (*Garden*, p. 281; 20/4/1901).—Useful hints for the "planting season," dealing generally with cultural requirements.—*H. J. C.*

Watsonia, (*Irideæ*). With photograph (*Rev. Hort. Belge*, February 1901).—M. Ch. Pynaert describes this genus.—*G. H.*

Weeping Cherries. By B. (*Garden*, p. 267; 13/4/1901).—Fig. of *Prunus avium pendula*. A list of the most suitable varieties, with short descriptions.—*H. J. C.*

Willows, Four New Species of, from Japan. By Otto v. Seemen (*Engl. Bot. Jahrb.* xxx. Beibl. 67, pp. 39–41; 12/3/1901).—The plants are from the collections of the Abbé Faurie.—*A. B. R.*

Wood Leopard Moth. By A. D. Webster (*Gard. Chron.* p. 185; figs. 72 and 73; 23/3/1901).—Fully described, with figures and methods of destruction.—*G. S. S.*

Wood Leopard Moth (*Zeuzera Æsculi*). By A. D. Webster (*Gard. Mag.* 2472, p. 164; 16/3/1901).—The writer describes the life history of this moth, the caterpillar of which is so destructive to various kinds of trees. Illustrations of the moth and its larva are given, and also of a branch showing the injury done by the caterpillar.—*W. G.*

Wood Leopard Moth (*Zeuzera Æsculi*). By A. D. Webster (*Garden*, p. 189; 16/3/1901).—The different kinds of trees subject to

attacks from this pest are enumerated. The different stages of life history and methods of destruction are described in detail.—*H. J. C.*

Wood, The Structure of. By H. Stone (*Journ. Hort.* 2728, p. 28; 10/1/1901).—An article to show that the structure varies infinitely in different kinds of wood, but is practically constant in the same species. *W. W.*

Wyethia mollis (*Compositæ*), California (*Bot. Mag.* tab. 7772). —A stout perennial herb with woolly leaves a foot long, heads 4 in. in diameter from tips of ray florets, of an orange-yellow colour.—*G. H.*

Xanthosoma Hoffmanni, Schott; (*Aroideæ*) Mexico. With woodcut in text (*Rev. Hort. Belge*, January 1901).—It is described by M. Micheli, and compared with other species.—*G. H.*

NOTE ON RUBBER-STRIP FOR GRAFTING.

By R. B. Rogers, A.M.Inst.C.E.

I have found pure rubber-strip a very useful material for grafting. This is the material which is used for insulating joints on electric wires, and can be obtained from dealers in electric wires in the form of a roll of tape. I first tried it in 1896, and after experimenting with it for a year or two I gave up the use of clay altogether for grafting on small stocks; it is not so suitable for grafting on large stumps. The graft may be cut to fit the stock in any of the usual ways, but care should be taken that there are no sharp edges left which might cut through the rubber-strip. About 4 or 5 inches, measured before stretching, is sufficient for most grafts on small stocks. Strip ½ inch wide weighs about 100 grains to the yard, so that 1 oz. is sufficient for about forty grafts. The rubber-strip must be well stretched before putting on, then wound round the joint so as to cover the whole of it from end to end, stretching it tightly in the course of laying it on; it then forms an air-tight covering and holds the graft very firmly. The end may be tied, but the neatest way is to moisten the end with rubber solution and stick it down. If very little solution is used, it will stick at once if pressed down firmly; if too much solution is used, it takes a little longer to set. Last year I was using old rubber-strip which I had had for several years, and I found that it perished quickly in the sun, and I lost several grafts due to the rubber coming off before the graft had united properly. This year I have covered the rubber with a layer of raffia put on loosely, simply as a protection from the sun, and have found it quite satisfactory. The protecting layer of raffia should be removed as soon as the graft has safely united, as it may form a harbour for vermin; but it is not necessary to remove the rubber, as it will stretch as the joint swells, and perish and peel off of its own accord after being exposed to the sun for some time. Rubber-strip may also be used for budding fruit trees; but it is not so suitable for roses, as the stocks are generally not strong enough to stand the strain of winding it on tightly.

COMMONPLACE NOTES.

By the SECRETARY and the SUPERINTENDENT.

THE NARCISSUS FLY—*Merodon equestris*, F.

THE enormous increase in recent years of the growth of Daffodils has brought with it a terrible increase in the number and distribution of this pest. Time was when it was quite unknown amongst us, but it has undoubtedly been imported from Holland and also, to my own knowledge, from Spain, as I once found no fewer than seven young grubs of the fly in a single imported bulb of Johnstoni, "Queen of Spain." Since those days it has increased with great rapidity, and is now far more generally existent amongst collections of Daffodils than the owners are aware of or are willing to admit. A knowledge of the beast and how to deal with him have therefore become matters of considerable importance.

The fly was first noted by Réaumur in 1738, but at that time it had probably not spread further northwards than the centre of France, and even there it was rare; and it was only in 1840 that it was noticed as a pest in Holland, and was handed on in due course to England and even America. In 1885 a monograph on the fly was published in Haarlem by Dr. J. Ritzema Bos, Professor of Agriculture at Wageningen, and this continues to be the standard authority. He tells us that the female fly, emerging from the chrysalis in May, may live until July and lay 100 eggs in that time, one by one, separately, throughout a month at least, laying them in the soil around the bulbs and amongst the foliage. He says that a few days after observing this he found a young grub on the outside of a bulb, but he did not see it bore itself a hole into the bulb. Réaumur, however, says that the grub enters the upper part of the bulb, and quits it, when full grown, at the base. This may be its general procedure, but it is not always so, for Dr. Bos says that, after examining more than a thousand bulbs attacked by the grubs, he found several which had only one hole, and that at the junction of the base of the bulb with the enveloping scales or coats, and also some which had no hole at all externally but yet contained a grub. This I also can confirm from my own frequent observation. In explanation Dr. Bos suggests that sometimes the hole of entrance is so minute when the grub has just emerged from the egg that the wounded tissue of the bulb has grown up again, leaving no trace. This appears to me unlikely, as the excreta of the beast would of itself, I think, be sufficient to keep open any hole once made, for it is distinctly acid. He then gives what I think is the true explanation—viz., that the young grub on emerging from the egg works its way down the tissue of the leaves till it reaches the bulb and penetrates between its coats, and thence begins to bore its tunnels, and so gradually descends towards the base, where, *as a rule*, it bores a way through, and perhaps sometimes escapes, though sometimes it seems as if it turned round at the base and bored its way up the other side of the bulb, and emerged almost exactly at the spot where it entered. One of the two

methods detailed in the last sentence is, I believe, invariably followed by the grub. Such being my theory, I have to account, first, for bulbs having a distinct hole in the base but from which the grub has not yet emerged; and, secondly, for bulbs having two distinct holes, one basal and one in the neck generally, and containing the grub still. First, it appears to me that the beast very often bores a hole through the base before it is ready to emerge, and that it does this probably for sewage purposes. Secondly, in the case of two distinct holes, I believe the one on the shoulder generally has been made by a half-grown grub migrating to a new home and boring its way in; it then bores on to make its sewage hole at the base, and having done this, fattens itself up upon the substance of the bulb. These are not entirely "guesses at truth," as I have seen more than one example—and Dr. Bos records a case—of an almost full-grown grub boring its way into a fresh bulb as the bulbs lay upon the shelf harvesting.

The full-grown fly can hardly be mistaken by any observant person, as its manner of flight is so distinct. In appearance it is not unlike a bee, but varies very much in the colouring of the body, having sometimes red, sometimes yellow, sometimes white stripes. They have only two wings. Their flight is their distinguishing mark. It is more like a drone bee's than anything I know, or like a humming-bird hawk moth. They hover over the Daffodil beds, moving their wings so swiftly that they do not seem to work them at all, and if undisturbed they will poise themselves thus for three or four minutes at a time without change of place or position, their wings going all the while with the utmost rapidity. Then suddenly they dart to right or left (hardly ever, I think, straight forward) with lightning speed—too quickly for the eye to follow them. One only sees them again at a few yards' distance a minute afterwards and guesses it is the same fly. I have often tried to catch them, but have never succeeded except when they are pairing, and then when once they have settled it is comparatively easy. I have never seen one settle at any other time.

This note has been called forth by the letter of a correspondent who says "I feel sure Merodon enters at the base . . . and generally comes out at the neck," and as my friend has this season been carefully observing all he can of the habits and life history of this pest, he has promised to bring the matter forward for discussion at one of the Society's April meetings next year. Perhaps other Daffodil growers will do the same, so that we may arrive at more accurate knowledge of the destroyer. Meanwhile the only remedy I know is to hand-pick all the bulbs carefully and systematically, going over them twice, during the last week in July and the first three weeks of August before replanting. Many growers like to replant early in August, but if they want to find and exterminate Merodon, they must once in a way be content to wait until September, as the grub is often not sufficiently grown to be readily noticed before the middle or end of August. I was myself once terribly plagued with Merodon, but have almost if not entirely got rid of him in this way. The worst of him is, he always attacks the rarest and most valuable amongst one's bulbs; it would almost seem as if some ratio existed between the value of a bulb and its toothsomeness and flavour to Merodon's palate.

TRIPLE DAFFODIL.

Twin-flowered Trumpet Daffodils are none too common, but never before have we seen a triplet as in fig. 115. It is a Trumpet Bicolor, grown by C. W. Cowan, Esq., in his garden at Valleyfield, Pennycuick, but the particular variety was not noticed when it was gathered. It is

FIG. 115.—TRIPLE-FLOWERED TRUMPET DAFFODIL.

not thought to have been altogether due to fasciation, as the stem only showed two stems blended together.

FAIRY RINGS.

"I should be glad to know the best method of cure and also the cause of so-called 'Fairy Rings' forming on lawns." These rings are caused by various kinds of fungi, generally, but not universally, of the Agaricus

tribe. Exactly why and how the fungus forms and spreads in a circle it is not now necessary to enquire: we all know the fact that it does so and that the Grass grows ranker and darker where the fungus is present. A dressing of slaked lime at the rate of 2 tons to the acre, or of basic slag at 1 ton to the acre, is a good remedy. Either of these will gradually cause the rings to disappear, though it will often be necessary to apply the dressing in two consecutive years. Of the two, basic slag is probably preferable, although it is a little slower in its action than the lime is. April is a good month for dressing the Grass, choosing showery weather so as to wash it in to the roots.

Silver Leaf.

A correspondent sends us shoots of Peach and Plum affected with Silver-leaf disease. The trees are growing in an unheated orchard house; they are about seven years old, and only four of them are at present attacked—last year it was only two of the Peaches, this year two of the Plums have followed suit. The rest of the trees appear quite healthy, nor has the disease as yet appeared out of doors. Sulphur has been tried, but without any useful effect. The garden in question is said to be very isolated, and until last year no sign of the disease had been noticed. The gardener at first thought that a superabundance of lime in the soil was the cause, as he recently had given a top-dressing which had contained a good deal of lime; but on hearing of a garden on soil absolutely devoid of lime suffered terribly from the disease, he has abandoned this view of the cause.

The fact of the matter is that the Silver-leaf disease is at present a puzzle. It attacks all trees of the Prunus tribe—Peaches, Plums, Portugal Laurels being the most notable victims. It is called Silver-leaf because it gives a silvery or ashen appearance to the surface of the leaf, and this seems to be caused by a separation having taken place between the outer skin of the leaf and its green inner substance and a thin film of air having got in between them; but what has caused this separation to come about is at present unknown. It attacks trees in apparently robust health just as much as the weaklier members, fixing itself first on one twig or bough and then on another, until at last it kills the whole tree. The only cure is to kill. Up with the tree, and for safety sake burn it root and branch—though there is no sort of evidence that the disease is infectious, in fact rather the opposite, still it is well to make sure. A young tree may be planted, as we have proved, at the same spot and not catch the disease. Gardeners would be most grateful to scientists if they could discover the cause and the cure of this trouble.

Vine Borders.

A Fellow writes asking whether it is necessary to have outside borders, and what depth they should be. He is advised that it is certainly better to build the front wall on arches and have both inside and outside borders, even if the outside one must (as in his case) be narrow. Two and a half feet is sufficient depth for the border, and if 6 inches of broken bricks or rubble is spread over the bottom and over the drain it should give drainage enough. On the broken bricks or rubble lay turfs with the

grass side downwards. The remainder of the depth of the border should be of good fibrous loam—the top spit of an old pasture for preference—mixed with old mortar or other lime refuse. Bones are not now considered necessary. The soil should be made firm as the making of the border progresses. This will give a border consisting of 2 feet of good soil, with 6 inches of drainage below.

Reclaiming Clay Land.

The land is pasture land on sticky yellow clay, and has been practically starved for a good time past. To have to deal with such land is heart-breaking work, and it is also a medium for throwing away a good deal of money to no purpose unless one proceeds very carefully. Probably one-half the trouble arises from the hard, impermeable condition of the soil, which in years of drought is calculated to make the trouble still greater; whilst in years of heavy rain, probably through imperfect drainage, the water will not get away, but lies and soddens in the ground. It is all very well to say "Drain the land," but such land will never pay for such expensive treatment nowadays. If one had an inexhaustible supply of farmyard manure, that would be the best thing to put on, but it is highly improbable there will be enough of this to spare. If there is, well and good, use it. It tends to lighten the character of the soil and makes it more open. Artificial manures would be of very doubtful use and should never be embarked upon without trial first on a small scale. Bones, for example, useful as they are on some lands, might here be merely money thrown away. A top dressing of nitrate of soda, 1 cwt. to the acre, used in spring, would ensure a crop of hay, but it would not benefit the land as a whole. The very best thing to try is basic slag, 8 cwt. to the acre. It may be put on any time from the end of November to the middle of January. It should be bought with a guarantee of containing 38 to 45 per cent. of phosphates, and of being of 80 to 90 per cent. of "fineness." It is not expensive, costing only about £2 a ton in London.

The Mangosteen.

In his very interesting and suggestive paper recommending the establishment of "Imperial Gardens" in all parts of the British Empire for the purpose of distributing different kinds and varieties of fruit trees, &c., Dr. Bonavia, at page 311, Vol. xxv., asks why the Mangosteen has not been introduced into Ceylon and cultivated for commerce. A correspondent writes that it has been so introduced and grown in Ceylon: "Amongst others who cultivated it was Sir Harry Dias, who grew it, not unprofitably, in his garden near Kandy. . . . It is in my opinion a very much overrated fruit, and I got very tired of it when resident for some years in the Malay Peninsula, as did also many others. . . . Believe me there is not a fruit peculiar to our Imperial possessions—the Mango not excepted—that comes near any of our best English fruits (European perhaps I should say), and I have had over twenty-three years' experience of the tropics." This exactly confirms our own idea of tropical fruits. They please our fancy for the moment now because we get them seldom, but the vast majority of them are really flat and mawkish, and wholly

lack the brightness of flavour (which we technically call 'sub-acid') which is the dominant characteristic of the fruits of temperate climes.

The Gooseberry Mite.

This is the type of a very common complaint this year: "I am sending you a Gooseberry bush I dug up yesterday. Nearly all my bushes are affected in the same way. They looked quite healthy and had promise of a fine crop of fruit. One after another they began to droop and wither away."

Like so many of us this year, our friend's bushes are attacked by the "Gooseberry Mite" (*Bryobia pretiosa*), and most destructive the pest is. The only thing one can do is to spray the bushes at once, and again next year, immediately the leaves are formed, with 2 oz. of Calvert's Carbolic Soft Soap dissolved in a gallon of water and applied warm. This may destroy the pest and will not hurt the bushes.

Affiliated Societies.

It may interest the Committees and Secretaries of all Societies affiliated to the Royal Horticultural Society to know that the Council have had a Medal and a Certificate (or Commendation) Card specially prepared for them. The Medal will have one side blank, so that the local Society can have its name, &c., engraved upon it, and the card will have a large blank space for the same purpose, encircled with a border of flowers and fruit in outline, with the Society's badge above. They will be obtainable, at their actual cost price, by the Secretaries of affiliated Societies, but by no one else.

Wire-Worm.

As a sample of scores of letters we quote the following: "Can you tell me a cure for wire-worm, or 'copper-worm,' in a greenhouse already planted with Tomatos?" The old method was slow, it was also, as far as it went, sure and harmless, and, though it is now pooh-poohed because it is old-fashioned, we would always advise trying it *together with* the newer plan. The old way is by trapping the wire-like grubs; putting slices of potato and of carrot on or hardly below the soil, and every morning examining them and killing all found feeding on the toothsome morsels which they love. The newer method is to spread kainit over the surface of the soil—4 oz. to each square yard—and water it well in, so that the whole of the soil is moistened. Wire-worms, leather jackets, eel-worms, and all such like pests have an intense dislike to kainit, and often disappear entirely after such an application. Care should be taken that the kainit does not fall upon the leaves of any plants.

What is a Cactus Dahlia?

This is a question addressed to us from the Antipodes, where an exhibitor had shown 'Miss Webster' amongst a collection in a class for "Cactus only." Now 'Miss Webster' happens to be one of the best "Decorative" Dahlias, splendidly pure white, and is said by the Nat. Dah. Soc. to "approach Cactus form," but the petals are too flat as a general rule to permit its being generally classed as a Cactus. All growers, however, of Cactus Dahlias know, first, that there are two or three different types of Cactus already; and, secondly, that most true

Cactus forms will, late in the season, give flowers with flattish or even quite flat petals instead of the orthodox twisted or recurved shape. At present, therefore, it is undesirable, as it is almost impossible, to draw a rigid line between the two types—Decorative and Cactus. It would be better if schedule makers would for the present allow Cactus and Decorative to be combined, and word their schedule somewhat thus: "Cactus and Decorative Dahlias—Show, Fancy Pompon, and Singles excluded," and if they wish to favour Cactus, add "True Cactus forms with reflexed or twisted florets will be preferred." It costs very little to add a few explanatory words in a schedule, and it saves much heart-burning.

Stable Manure.

It has frequently been said that when the horses or cattle have been fed on brewers' grains the resulting manure has an injurious effect on plant life and health. It may be so, but we cannot quite see why, and nowhere can we find the matter proved. But in the case of stables where Peat-moss is used instead of straw it has been over and over again proved to be injurious when used in quantity unless the watering pot is used with the utmost care and skill. A correspondent tells of a Cucumber bed, a Mushroom bed, and a bed for early Kidney Beans. "The plants started well and then withered away. . . . The soil always keeps damp . . . and never seems to want water. . . . There was very little straw in the manure, and that little was picked out." We feel almost certain this was a case of Peat-moss manure, which is so excessively retentive of moisture that unless the watering can is used with the utmost care and discretion it turns sour and stagnant and kills the roots of almost any plant. Our correspondent, however, does not *think* it was Peat-moss, and if he be right then probably a very similar mechanical condition of the manure had been brought about by the mistaken zeal displayed in picking out all the straw. Add to this the possibility of the horses having been fed more or less on grains, and the straw-picked manure can be easily imagined to be in as retentive a condition as if Peat-moss had been used.

Grape 'Madresfield Court.'

A Fellow writes to ask why her 'Madresfield Court' Grapes "are all splitting, whole bunches going so." This is by no means an uncommon complaint of this delicious Grape. It is constitutionally apt to split its berries on the smallest provocation, particularly if the drainage is in the slightest degree faulty. It is also a variety which requires more air than almost any other, so that unless it be planted at the end of a vinery, or, better still, has a house to itself, it is a very difficult Grape to manage. Allowing the border to get a little on the side of too dry, and then giving it a regular soaking, almost inevitably results in the splitting of a large proportion of the berries and the spoiling of almost all the bunches in consequence. The essentials for success with it are (1) perfect drainage; (2) plenty of air whilst ripening; and (3) the utmost care, attention, and watchfulness in watering, avoiding equally too much and too little. It is, however, such a delicious grape when well grown that it thoroughly deserves a house to itself whenever this is at all possible.

BOOKS RECEIVED.*

"Wall and Water Gardens." By Gertrude Jekyll. (Geo. Newnes, Ltd., London.) 12*s.* 6*d.* 8vo.

Any book, on any branch of gardening, bearing Miss Jekyll's name needs no further recommendation. This book confines itself to "beautiful mountain plants and the plants of marsh and water," and we can only hope it is intended to be one of a series yet to come from the same delightsome pen—delightsome, not simply in the subjects which Miss Jekyll chooses, but in the charm of that rare combination of scholarly English, simplicity of language, and happiness of expression. All garden-lovers will rejoice in it. The type is clear and excellent, and there are upwards of 130 full-page illustrations printed in that absolutely perfect way so well known to all readers of "Country Life."

"Workmen's Compensation Acts." By W. A. Willis, LL.B. (Butterworth & Co., London.)

A useful little hand-book containing the text of the Acts of 1897 and 1900, together with explanatory notes and explanations, and also with references to all the cases which have been brought into the Courts since the Acts were passed and the decisions given therein. It is a useful manual for employers and employed alike.

"The Art and Craft of Garden Making." By Thomas H. Mawson. (B. T. Batsford, 94 High Holborn, London.) 25*s.* Royal 4to.

A fine volume, evidencing a vast amount of study bestowed upon the making, and fashion, and laying-out of gardens ornamental and useful. One of the author's objects is to gather together all that is good and beautiful from every style of garden, and to combine them, so far as they will harmonise with the architecture and general surroundings of the house. He treats of the site, the gates, hedges, fences and drives, the flower-garden, lawns, and walks, sun-dials, seats, and summer-houses, greenhouses for flowers and fruit culture, ponds, lakes and streams, kitchen gardens, orchards, trees and shrubs, landscape gardening, &c., and gives no fewer than 130 plans and details, besides a large number of full-page illustrations. Anyone thinking of laying out a new garden or remodelling an old one would do well to consult this work.

"Cassell's Dictionary of Gardening." Edited by Walter P. Wright. (Cassells, London and New York.)

A work which has the advantage (or disadvantage) of coming out in monthly parts, of which there are to be "about 20, each 7*d.* net." The first three parts have reached us. It combines the idea of a Dictionary

* Authors and Publishers wishing books reviewed are particularly requested to state the price of each work.

with full directions for propagation and culture, and bestows as great care on the fruit and vegetable as on the flower garden and greenhouse. The type, though necessarily somewhat small, is exceedingly clear even for old eyes and its pages are brightened by abundant and beautifully printed illustrations. It is thoroughly practical, and its value and cheapness should commend it widely.

"Orchid Guide." (Sander & Co., St. Albans.) 10*s*. 6*d*. 8vo.

A list of all the Orchids and their hybrids known to be in cultivation up to January 1901. It gives the name, native country, description, season of flowering of each, and the price of the majority, with a brief general cultural note. It must have entailed an enormity of labour, and should be welcomed by all Orchid growers and specialists.

"The British Gardener." By W. Williamson. (Methuen & Co., London.) 10*s*. 6*d*. 8vo.

A manual of 400 pages treating of landscape gardening, plants, fruit, flowers and vegetables. It contains a vast mass of information and reading, and deals with the commercial aspect of the disposal of surplus produce, and also with exhibiting. We are not sure whether the author is quite full enough in his selections of hardy flowers; for example, under *Iris germanica*, he only gives six varieties, which will seem a somewhat meagre allowance to anyone who is fond of these plants. Six Daffodils only are mentioned, and they all of the Ajax class; whilst the whole vast family of Orchids is dismissed in ten pages, and Palms in only eight. Fruit and vegetables are, however, much better treated, especially the former. There is much that is useful in the book, but it is not very well balanced and hardly escapes the adjective "scrappy."

"Royal Gardens, Kew." By E. J. Wallis. (Effingham Wilson, Royal Exchange, London.) 2*s*. 6*d*.

The book consists of thirty remarkably good reproductions of photographs of views in the Gardens. The letterpress describing each view is most commendably short and to the point, though containing all the information required.

"Gardening for Beginners." By E. T. Cook. (George Newnes, Ltd., London.) 10*s*. 6*d*. 8vo.

The work which Mr. Cook has proposed to himself is said in a preface by Miss Jekyll to have been to produce "a truly beginner's book," "so plain and easy that it does not either alarm or discourage an absolute novice." Certainly this preface is altogether admirable. And when we turned to the book itself the very first paragraph, which happens to be on Snapdragons, pleases us: "Striped, speckled, and bizarre" varieties "are not desirable . . . avoid the Tom Thumb group . . . in which all the natural grace of the plant is lost." This is the sort of teaching that we like, and there is abundance of such like throughout the book, together with cultural details which, whilst being as good as could be given, are also quite simple and easy to be followed by an absolute beginner. The book treats of garden and border plants from seed and cuttings, of annuals,

climbers, bulbs, roses, chrysanthemums, orchids, ferns, greenhouse plants, shrubs, &c., of the making of lawns, and rock-gardens. But, finding that Mr. Cook was thoroughly in his element amongst flowers, we turned to the fruit and vegetable sections to try to find some faults, and we can only confess our utter failure. These sections are as good, and clear, and helpful as the others. The book is full of excellent diagrams and full-sized plates, which have been so wisely chosen that they not only brighten up the pages but to no inconsiderable extent add to the book's teaching power. We commend the book most thoroughly. We have only found one fault: would that Mr. Cook would use the word "variety" and not "kind." There are multitudes of varieties of almost all garden flowers, fruits, and vegetables, but there are comparatively very few kinds indeed, and it would have been well to accustom the beginner to the distinction between the two words. This is, however, perhaps somewhat hypercritical, and anyone who wishes to give a friend a welcome book for the garden cannot do better than invest his half-guinea here.

"The Book of Gardening." Edited by W. D. Drury. (L. Upcott Gill, Strand, London.) 16*s.* 8vo.

A book of 1,200 pages! It would have been far better in two volumes. 1,200 pages is too much to hold in the hand without actual pain. The paper and print are excellent, and the illustrations many and pleasing. It opens with a very useful chapter on elementary landscape gardening, and ends with an equally useful one on manures, which, if it is not quite so elementary, is at the same time perfectly understandable by anyone; in fact, we are inclined to consider this chapter on manures as the most valuable one in the whole book. The other chapters treat of all the ordinary classes of flowers, of hardy and rock plants, of bulbs, shrubs, orchids, ferns, greenhouse and aquatic plants, fruit, and vegetables. There is a chapter on propagation, another on forcing, another on diseases and pests. We are sorry to find even twelve valuable pages given up to the abominable system of "Carpet Bedding"; we had hoped the taste for it had quite died out and been decently buried in the last century. However, in some remote corner of earth's surface there may survive devotees of this iniquitous system, and, if they should be induced hereby to buy the book, it will (unconsciously it maybe) lead them on to better things, as undoubtedly the book is a good and useful book.

"Open-Air Gardening." Edited by W. D. Drury. (L. Upcott Gill, Strand, London.) 7*s.* 6*d.*

This is an abridgment of the last-named book, reducing it from 1,200 to 400 pages. A good deal seems to have been lost in the abridgment; notably the whole of the valuable chapter on Manures is missing. We prefer the unabridged.

"The Story of Wild Flowers." By the Rev. Professor George Henslow, V.M.H. (George Newnes, Ltd., London.) 1*s.*

Professor Henslow is always interesting, and no one need grudge a shilling for this most instructive little book of 250 pages. The reader

will find herein plenty of argument and example of the Professor's cherished doctrines: first, that all plants contain within themselves the power of varying definitely so as to adapt themselves to any changed surroundings and conditions of life in which they may happen to find themselves; and, secondly, that the structure of all flowers has in each case actually come about by the plant's efforts to adapt itself to the convenience of the insects which visit it and assist in its pollination. It is a most instructive little book, although the Professor occasionally uses hard and technical words and expressions without explaining them sufficiently often to suit the ignorance of his reviewer.

"Greenhouse Construction." By B. C. Ravenscroft. (L. Upcott Gill, Strand, London.)

A thoroughly practical book without being too technical. It reviews the whole process of building and heating, from laying the foundation up to the completed greenhouse. The different forms of house and their suitability to different purposes are discussed, also staging, pits and frames, painting and glazing, and at least one-third of the book is devoted to boilers and heating. It will be invaluable to anyone proposing to erect new houses or to reheat or reglaze an old one.

"The Gardener's Assistant." By Robert Thompson. New edition by W. Watson, F.R.H.S. (Gresham Publishing Company, London.) In 4 vols., 8*s*. each.

Vol. iii., lately published, deserves in every respect the excellent report of Vols. i. and ii. given at page 373 of our last issue (Vol. xxv., Part 3). The work has been admirably done, and were Mr. Thompson still here we are confident that he would express his grateful thanks to the Editor of this re-issue of one of our best standard books.

"Dictionary of Gardening, The Century Supplement to." By George Nicholson, F.L.S., F.R.H.S., &c. (L. Upcott Gill, Strand, London.) Large post 4to. 18*s*. 6*d*.

Everybody in any way interested in gardens knows that Mr. Nicholson's Dictionary is an absolute *sine quâ non*. It is *the* book of reference for all gardeners, professional and amateur, and is universally regarded as an "authority" on all that it deals with. The present supplement has been issued in order to keep the Dictionary fully up to date in new introductions and in all branches of recent research and discovery. When we say that this supplement is in every respect equal to the previous parts of the work and is full of illustrations of new and rare plants we have said more than enough to make all who possess the older volumes desire to add this new one to their library shelves, and all gardeners or garden lovers who do not possess the older volumes should at once procure the whole work. It is a book we cannot possibly do without.

"Gardens, Old and New." (George Newnes, Ltd., London.) Folio. £2 2*s*.

A truly sumptuous volume issued from the "Country Life" office. Most Fellows of the Royal Horticultural Society are, we hope, readers

of "Country Life," the most delightful of all weekly papers. If so they will be able to form some idea of the beauty of the present volume, as it is designed very much on similar lines—"but much more so." About seventy of the most beautiful country houses of England, famed for their gardens, have been selected. Each is fully described in the pleasantest possible letterpress and illustrated with the most lavish illustration it has ever been our lot to meet with. Many of the illustrations are full folio size, and their value and suggestiveness to those who are planning or altering gardens is enormously enhanced by the fact that every one of them is the reproduction of an actual photograph, thus teaching us not what an artist may dream of, but what a mere mortal may produce and has produced in his garden. The book consists of 320 pages, and on a rough calculation it contains more than 350 of these magnificent photographic reproductions. It is a book which no country house calling itself a "Country House" should be without.

EXAMINATION IN HORTICULTURE.

1. The Council of THE ROYAL HORTICULTURAL SOCIETY, sympathising with the efforts of various County Councils, Technical Institutes, Schools, Gardeners' Mutual Improvement Societies, and other bodies to promote instruction in Practical Horticulture by means of Lectures, Demonstrations, &c., and in the hope of rendering such teaching more definite and effective, have consented to hold an Examination in Horticulture in the month of April in each year.*

2. The following is an Outline Syllabus, showing the nature of the subjects to which it is considered desirable that the attention of Students should be drawn.

ELEMENTARY PRINCIPLES

On which Horticultural Practice is based.

(1) Soils, good and bad: their Mineral Composition; Chemical Nature of Fertilisers and their respective values.
(2) The Physiological values of Water, Heat, and Air in Plant-growth.
(3) The Structure of Seeds and their Modes of Germination; the Chemical Phenomena of Germination; the Movements of Seedlings and the Uses of them.
(4) The Functions of Roots; their Anatomical Structure; Hindrances to Healthy Root-action and their remedies.
(5) The Uses of Stems and Branches; the Anatomical Structure of ordinary Dicotyledonous and of a Monocotyledonous Stem.
(6) The Physiological Functions of Leaves, and the Action of Light upon them.
(7) The Structure of Tubers and other Subterranean Stems; the Structure of Bulbs and Buds; the General Phenomena of Vegetative Multiplication.
(8) The Physiological Processes undergone in Growth and Development; the Structure of an Active Cell, and the process of Cell-division and the formation of Tissues.
(9) The Structure of Flower-buds and of Flowers; the Methods of Pollination, Natural and Artificial.
(10) The Process of Impregnation of the Ovule, and the Formation of Embryo and Endosperm.
(11) The Classification and Description of Fruits; the Changes and Development during Ripening.
(12) The General Characters of the Commoner Families of Plants in Cultivation.
(13) The Origin of Species.

HORTICULTURAL OPERATIONS AND PRACTICE.

(1) Surveying and Landscape Gardening: Elements of.
(2) Choice of Site for Garden.
(3) Description and use of Implements under each head.
(4) Operations connected with the Cultivation of the Land, with explanations and illustrations of good and bad methods: Digging and Trenching; Draining; Hoeing, Stirring the Soil, and Weeding; Watering; Preparation of Seed Beds; Rolling and Raking, Sowing, Transplanting and Thinning; Potting, Planting; Aspects, Positions and Shelter; Staking; Earthing and Blanching, &c.

* The exact date can be ascertained by sending a directed post-card for reply to the Office in January, February, or March.

(5) Propagation, Elementary Principles: Cuttings, Budding and Grafting, Stocks used, Layering, Division, Branch Pruning, Root Pruning; Old and Young Trees and Bushes. Training.
(6) Fruit Culture: Open Air and Under Glass; Small Fruits; Apples and Pears; Stone Fruits; Gathering and Storing; Packing and Marketing. General Knowledge of Fruits, and Selection of Varieties.
(7) Vegetable Culture: Tubers and Roots; Green Vegetables; Fruits and Seeds; Rotation of Crops, and Selection of Varieties.
(8) Flower Culture, Outside and Under Glass.
(9) Manures and their Application.
(10) Improvement of Plants by Cross-breeding, Hybridisation and Selection.
(11) Arboriculture: Trees and Shrubs and their Culture.
(12) Insect and Fungus Pests: Prevention and Treatment.

3. Students and young gardeners not having had the advantage of attending Lectures, but wishing to present themselves at some one of the Centres for Examination, might with advantage consult some of the following works:—

"Primer of Botany," by Sir J. D. Hooker, K.C.S.I. (Macmillan & Co., 30 Bedford Street, W.C.) 1*s.*

"Elementary Botany," by J. W. Oliver. (Blackie & Sons, 50 Old Bailey, E.C.) 2*s.*

"Botany for Beginners," by Professor Henslow. (Stanford.) 2*s.* 6*d.*

"Floral Dissections," by Prof. Henslow. (Stanford.) 4*s.*

"How to Study Wild Flowers," by Professor Henslow. (R.T.S.) 2*s.* 6*d.*

"Structural Botany" (Flowering Plants), by Dr. D. H. Scott. (A. & C. Black, Soho Square, W.C.) 3*s.* 6*d.*

"Plant Life," by Dr. M. T. Masters, F.R.S. (Vinton & Co., 9 New Bridge Street, E.C.) 2*s.* 6*d.*

"Plant Breeding," by L. H. Bailey. (Macmillan & Co.) 4*s.*

"Elements of Agriculture," by W. Fream, LL.D. (J. Murray, Albemarle Street, W.) 3*s.* 6*d.*

"Primer of Horticulture," by J. Wright, V.M.H. (Macmillan & Co.) 1*s.*

"Physiology of Plants," by Dr. Paul Sorauer. (Longmans, Green & Co., 39 Paternoster Row, E.C.) 9*s.*

"Chemistry of the Garden," by H. Cousins. (Macmillan & Co.) 1*s.*

"Diseases of Plants," by H. Marshall Ward. (S.P.C.K., Northumberland Avenue, W.C.) 2*s.* 6*d.*

"Profitable Fruit Growing," by J. Wright, V.M.H. (Journal of Horticulture, 12 Mitre Court Chambers, E.C.) 1*s.* 3*d.*

"Art of Budding and Grafting," by C. Baltet. (Crosby Lockwood, Stationers' Hall Court, E.C.) 2*s.* 6*d.*

"Pruning," by L. H. Bailey. (Macmillan & Co.) 5*s.*

"Natural History of Plants." 2 vols. By Kerner and Oliver. (Blackie & Son.) 50*s.*

4. The Examination will be held simultaneously in as many different centres in Great Britain and Ireland as circumstances may demand. The time allowed for the Examination is 2½ hours, the hour fixed being generally from 7 to 9.30 P.M.

5. The Examination will for the most part be based on the above Outline Syllabus of "Elementary Principles of Horticultural Operations and Practice."

6. 300 Marks will be given as a maximum. Candidates gaining 200 Marks and over will be placed in the FIRST CLASS. Those gaining 150 to 200 Marks will be placed in the SECOND CLASS, and those gaining between 100 and 150 will be placed in the Third Class. Candidates failing to obtain 100 Marks will not be classed.

7. The Royal Horticultural Society will award a Silver Gilt Medal to

the Candidate gaining the highest number of Marks, and will also send to the Candidates Certificates of the Class in which they shall have passed.

8. County Councils, Lecturers, &c., must send in to the Society the actual number of Candidates at each proposed centre **at least ten days** before the Examination takes place.

9. Gardeners and Students wishing to sit for the Examination, who have not attended any particular series of Lectures, must send in their name and address, and also the name and address of some responsible person willing to conduct the Examination (*see* par. 13), to the Secretary, R.H.S., 117 Victoria Street, Westminster, at least three weeks before the date of Examination.

10. Every Student wishing to be examined must, as far as possible, give all the information asked for by filling up a form, which will be supplied on application to the Secretary.*

11. A capitation fee of 3*s.* will be charged for every Student, in order to partially defray the expenses of the Examination.

12. County Councils, Lecturers, and others desiring to have an Examination held in their neighbourhood must also send in the full name and address (with designation or occupation) of one responsible person for each proposed centre, who will undertake to supervise the Examination in accordance with the Society's rules.

13. N.B.—The Society is willing to hold an Examination wherever a magistrate, clergyman, schoolmaster, or other responsible person accustomed to Examinations will consent to supervise one on the Society's behalf, and in accordance with the rules laid down for its conduct.

THE DUTIES OF A SUPERVISOR.

(*a*) To satisfy himself that the room proposed for the Examination is a suitable one for the purpose, and to see that a sufficient quantity of foolscap paper, *all of one size*, is provided for the use of the candidates.

(*b*) To satisfy himself that all candidates belonging to his centre have been duly acquainted with the place, day, and hour of Examination. This may be done by communicating with the Lecturer, or with the Secretary of the County Council, &c.

(*c*) To receive the sealed parcel of papers which will be posted to him from London two clear days before the Examination. N.B.—If the

*** A stamped and directed envelope must be enclosed with all communications requiring a reply. Copies of the Questions set at the Examinations 1893–1900 (price 6*d.*, or 2*s.* 6*d.* a dozen) may be obtained at 117 Victoria Street.**

papers do not arrive by the first post on the day of Examination, he should *immediately* telegraph to the Secretary of the Society, 117 Victoria Street, S.W. Telegraphic Address: "Hortensia, London."

(*d*) To preserve the seals of the parcel *unbroken* until he opens it *in the presence of the candidates,* at the hour fixed for the Examination to commence.

(*e*) To distribute one copy of the Examination Paper to each candidate. It is better that the candidates should be seated not too closely together.

(*f*) The Supervisor will then *immediately* read aloud the directions printed at the head of the papers, make a note of the exact time, and inform students distinctly of the exact hour at which all papers must be handed in.

(*g*) To see that the following rules are strictly observed :—

1. Two-and-a-half hours are allowed for the paper.
2. Students are not allowed to bring any books, paper, notes, &c., into the Examination Room; nor to ask any questions whatever, save of the Supervisor, who must exercise his judgment as to whether such question is one he should answer or not.
3. Students are not allowed to leave the Examination Room on any pretext whatsoever after the papers have been distributed. In case of unavoidable illness, the Student must be content either to hand in what he has already done, or to wait till another Examination takes place.
4. Any Student leaving the room before the full time allowed has expired must first give up to the Supervisor his written papers.
5. The papers of any Students breaking these rules, or found copying, should at once be destroyed.

(*h*) The allotted time having expired, the Supervisor will call on the Students to fold up and hand in their papers, which should then be *at once* (before leaving the room) tied together securely with string. They should be posted to the Secretary, R.H.S., 117 Victoria Street, Westminster, S.W., by the earliest possible post.

(*i*) The Supervisor will, of course, not himself leave the room during the time of Examination.

(*k*) The Supervisor is requested to sign the following form, and return it with the Students' papers to the Secretary, R.H.S., 117 Victoria Street, London, S.W.

I hereby certify that the Examination in Horticulture held at

has been conducted strictly according to the rules and regulations of the Royal Horticultural Society.

Supervisor's Signature

Date

*** The Council of the Royal Horticultural Society reserve to themselves the right to modify the application of these regulations as they may consider necessary, and all disputed questions of interpretation and procedure must be referred to them for final decision.

SCHOLARSHIPS.

Sir Trevor Lawrence, Bart., V.M.H., President of the Society, and Master of the Worshipful Company of Gardeners, very kindly offered a Scholarship of £25 a year for two years, to be awarded after the examination of the Royal Horticultural Society in 1894, to the Student who should pass highest, if he were willing to accept the conditions attaching thereto. The main outline of these conditions is that the holder must be of the male sex, and between the ages of 18 and 22 years, and that he will study gardening for one year at least at the Royal Horticultural Society's Gardens at Chiswick, conforming to the general rules laid down there for Students. In the second year of the Scholarship he may, if he likes, continue his studies at some other place at home or abroad which shall be approved by the Master of the Worshipful Company of Gardeners, and by the Council of the Royal Horticultural Society.

A similar Scholarship was presented by Baron Schröder, V.M.H., after the 1895 examination.

The Worshipful Company of Gardeners continued this Scholarship to the end of 1896.

Another similar Scholarship was given after the 1897 examination by N. N. Sherwood, Esq., V.M.H., Master of the Worshipful Company of Gardeners.

Another was given for 1898-9 by G. W. Burrows, Esq., a Member of the Court of the same Worshipful Company of Gardeners.

Another was given for 1899–1900 by the Right Hon. the Lord AMHERST, who presents it also through the Gardeners' Company.'

Another is promised for 1901 by HENRY WOOD, Esq., which will be continued in 1902 by F. G. IVEY, Esq., both gentlemen being Members of the Court of the Worshipful Company.

SCHOLARS :—

1894–5–6	Mr. W. N. SANDS.
1895–6–7	Mr. G. F. TINLEY.
1897–8–9	Mr. H. S. LANGFORD.
1898–9	Miss HARRISON.
1899–1900 . . .	Mr. C. J. GLEED.
1900–1	Mr. B. SMITH.
1901	Mr. CHARLES H. BUCK.

If the Student who is at the head of the examination is for any reason unable or unwilling to accept the Scholarship, it is then offered to the next highest on the list, and so on throughout the First Class. And in case of two or more eligible Students being adjudged equal marks, the Council reserve to themselves the right to decide which of them shall be presented to the Scholarship.

RESULT OF THE EXAMINATION IN HORTICULTURE, 1901.

THE Annual Examination in the Principles and Practice of Horticulture was held on April 24; 225 papers being sent in.

Three hundred marks were allotted as a maximum, and all candidates who obtained 200 marks and upwards were placed in the First Class. The total number was 109, or 48·4 per cent.

The highest number of marks, 290, was awarded to Miss Ella M. Watkins, from the Horticultural College, Swanley, Kent.

Those who secured 150 and less than 200 marks were placed in the Second Class. The number was 85, or 37·7 per cent.

Those who obtained 100 marks and upwards were ranked in the Third Class. The number was 25, or 11·1 per cent.

Six candidates, obtaining less than 100 marks, were not placed.

Comparing these results with those of the last two years the entry has slightly decreased, viz., from 236 in 1900, to 225 in 1901; both are, however, greatly in excess of the number of entries, viz. 165, in 1899.

It will be noticed that the percentages have fallen in the First and Third Classes, viz., from 60 to 48 in the former, and from 13 to 11 in the latter; but in the Second Class they have risen from 26 to nearly 38; that is as compared with the results of 1900.

The lowering of the percentages of the First Class may be attributed to a slightly increased difficulty in some of the questions, more especially in the "Principles." It was felt by the Examiners that the "Requirements" drawn up some years ago scarcely met the increased knowledge of many students, especially when prepared at the various Horticultural Colleges. A new Syllabus of Botanical Requirements will be issued for 1902.

The decrease in the percentages of the Third Class is a good sign, as it indicates a greater preparedness in the majority of the Examinees.

It is very satisfactory to report that the steady improvement in the answers to the questions in the "Practice" continues, although there is still room for improvement in some directions. Some candidates had full knowledge of the Elementary Principles, but failed altogether when they came to the Practice. Candidates would do well to remember that a gardener may rise high in his profession with little or no knowledge of the composition of plants or trees, and may never have heard of Phloëm or Xylem; but cannot possibly do so unless he knows—when and how to repot choice plants; the rotation of crops in the kitchen garden; the best kind of fruit trees to plant and the right time to plant them, and so on. Some of the candidates could not name a succession of varieties of Pears, and did not know the name of even one stewing Pear. Some of them would sow Scarlet Runners in March in rows two feet apart. No gardener will ever attain a high position in his profession unless he is careful to obtain a full practical knowledge of the minor details of garden work; as, *e.g.*, how to handle a spade or lay down a rake. A novice usually lays

down the latter with the teeth upwards, and will shock the sensibilities of a well-trained gardener by the way he stands over his spade. Without any doubt it is well that students should have as much knowledge as they can possibly obtain of the Elementary Principles; but this can never take the place of the Practical part which should be studied quite as freely, and especially in and by actual practice.

(Signed) GEORGE HENSLOW.
JAMES DOUGLAS.

First Class.

		No. of Marks gained.
1.	Watkins, E. M., F.R.H.S., Swanley College	290
2.	Squire, E. F., Swanley College	280
3.	Ardington, M., Swanley College	270
	Shrubshall, A. H., Essex County School of Horticulture, Chelmsford	270
5.	Clapham, V. H., Swanley College	260
	Cooper, J. J., F.R.H.S., School House, Chase Terrace, Walsall	260
	Goffin, L. L., Essex County School of Horticulture	260
	Sansom, M., British School, Wimbledon	260
9.	Cresswell, W. T., Oxford City Technical School	255
	Wright, F. D., Reading College and Lady Warwick Hostel	255
11.	Draper, H., Swanley College	250
	Jones, W., 40 Mornington Road, Wanstead	250
	Nicholson, G. O., F.R.H.S., Rose Hill, Market Harboro'	250
14.	Adams, L. L., Reading College and Lady Warwick Hostel	245
	Balch, A., Wallacestone Manse, Polmont Station, N.B.	245
	Bedell, E. W., Swanley College	245
	Chandler, A. E., Puttenham School, Guildford	245
	Fleischmann, M. D., Claremont Cottage, Ilkley	245
	Gandy, L. A., F.R.H.S., Lustleigh, South Devon	245
	Henderson, A., Swanley College	245
	Leyshon, R., City Technical School, Oxon	245
	Peacock, F., Reading College and Lady Warwick Hostel	245
	Rendle, A., Essex County School of Horticulture	245
	Thomson, B. D., Swanley College	245
25.	Atkins, T. L., Middlefield, Hinckley	240
	Brooker, H., The School, Ewhurst, Guildford.	240
	Cull, A., F.R.H.S., Preston Patrick School, Milnthorpe	240
	Hall, H., Howe Green, Hertford	240
	Hanson, L., Swanley College	240
	Herring, L. K., Swanley College	240
	Humphrey, L. J., Essex County School of Horticulture.	240
	Johnston, J., 8 Dunrobin Place, Edinbro'	240
	Law, C., Reading College and Lady Warwick Hostel	240
	Wright, E., Swanley College	240
35.	Cornelius-Wheeler, B.R., Reading Coll. & Lady Warwick Hostel	235
	Dowie, T. M., Reading College and Lady Warwick Hostel	235
	Geary, G., The Pines, Salem Road, Burbage	235
	Macara, L. E., Swanley College	235

		No. of Marks gained.
35.	Meyler, K. G., Swanley College	235
	Parker, J. W., Horticultural School, Holmes Chapel	235
	Usher, M.,Swanley College	325
42.	Billington, F. H., Horticultural School, Holmes Chapel	230
	Blencowe, J., Eastcott House Gardens, Kingston Hill	230
	Canning, R. L., Marchwiel Hall Gardens, Wrexham	230
	Coleby, H., Reading College	230
	Creaser, W., 2 Rossington Grove, Leeds.	230
	Landsberg, M. H., Reading College and Lady Warwick Hostel	230
	Macara, M. G., Swanley College	230
	Piggott, W. H., Bicester, Oxon	230
	Sandys, A., Reading College	230
	Swift, J. W., County Technical School, Stafford	230
	Unwin, M. W., Reading College and Lady Warwick Hostel	230
	Williams, T. O., Albion Lodge, Hollingworth	230
	Wimpress, H., Swanley College	230
55.	Bateman, G., City Technical School, Oxon	225
	Carlyon, M., Reading College and Lady Warwick Hostel	225
	Coutts, W., 67 Cameron Street, Stonehaven	225
	Marriott, W. E., c/o Mrs. Cumpton, Burbage, Hinckley	225
	Rabjohn, H., Preston Hall Gardens, Aylesford	225
	Scott, L., Horticultural School, Holmes Chapel	225
	Webster, J. J., 24 Green Road, Skelton-in-Cleveland	225
62.	Colvile, K. J., Whitmore, Wolverhampton	220
	Nudds, H., City Technical School, Oxon	220
	Whetham, V. S., Swanley College	220
65.	Critchison, N. M., Swanley College	215
	Fenoulhet, S., Swanley College	215
	Jackson, B., Swanley College	215
	Johns, R., Reading College, Berks	215
	Little, H., Essex County School of Horticulture	215
	Martin, T. M., City Technical School, Oxford	215
	Murrell, M., Reading College and Lady Warwick Hostel	215
	Salway, S. J., County Technical School, Stafford	215
	Saunders, B., Essex County School of Horticulture	215
	Schattner, K., Swanley College	215
	Shimmons, O., 35 Webster Hill, Dewsbury	215
	Smith, E., Swanley College	215
	Tickner, A. E., Farncombe Schools, Godalming	215
	Wallas, C. M., Swanley College	215
79.	Buttenshaw, W. M., Swanley College	210
	Cook, L. J., 12 Henrietta Villas, Bush Hill Road	210
	Grundy, S., Swanley College	210
	Huckle, M. J., 53 Birkenhead Avenue, Kingston-on-Thames	210
	Muscott, W., City Technical School, Oxford	210
	Pownall, F., County Technical Schools, Stafford	210
	Taylor, W. G., North Hagbourne, Didcot	210
86.	Butler, E. W., Swanley College	205
	Jones, P. L., Reading College	205

		No. of Marks gained.
86.	Peache, F. W., Swanley College	205
	Stone, F. C., Schoolhouse, Brawley, Guildford	205
	Blaber, J., Hill View, Normandy, Guildford	200
	Buck, C. H., Swanley College	200
	Clayson, J., Wrest Park Lodge, Silsoe, Ampthill	200
	Creasy, B., Essex County School of Horticulture	200
	Davidson, W., The Gardens, Stagshaw, Corbridge-on-Tyne	200
	Dines, J., Essex County School of Horticulture	200
	English, M., Swanley College	200
	Higgs, K., Reading College	200
	Humphrey, H., Swanley College	200
	King, R. G., Swanley College	200
90.	Kinnear, K., Swanley College	200
	Lewis, F., Swanley College	200
	Marriott, E. E., Shackleford, Godalming	200
	Nash, A. W., City Technical School, Oxford	200
	Pugh, B., Highfield, Castle Bromwich, Birmingham	200
	Selden, G. P., Gardens, Woodhatch House, Reigate	200
	Smith T., Cambusdson Gardens, Ayr, N.B.	200
	Stoney, J. G., Sudley Road, Aigburth, Liverpool	200
	Stonhouse, E. M., Reading College and Lady Warwick Hostel	200
	Woodroof, C., County Technical Laboratory, Chelmsford	200

Second Class.

	Bayliss, I., City Technical School, Oxon	195
	Brown, S., Edwinstone, Newark, Notts.	195
	Burton, M. E., 6 Duddingston Park, Portobello	195
	Cundy, C., F.R.H.S., Sudbury, Suffolk	195
	Hughesdon, M., Reading College and Lady Warwick Hostel	195
110.	Mason, A., Essex County School of Horticulture	195
	May, B., Essex County School of Horticulture	195
	Palmer, J., Pierremont Nursery, Darlington	195
	Robb, A., Essex County School of Horticulture	195
	Swainson, W. T., Swanley College	195
	Taylor, L. W., Schools, Clanfield, Farringdon	195
	Berry, O., Horticultural School, Holmes Chapel	190
	Cobbold, H. M., Swanley College	190
121.	Draper, M., Swanley College	190
	Edwards, C., Trewyn Gardens, Abergavenny	190
	Leighton, F., School House, Lydiard Tregoze, Wootton Bassett	190
	Grace, M. F., Reading College and Lady Warwick Hostel	185
	Horne, A. J., 1A Lewisham Road, Highgate Road, N.W.	185
	Lester, T., Horticultural School, Holmes Chapel	185
	Morris, T., 2 Aelybryn Terrace, Burry Port	185
126.	Paul, F. F., F.R.H.S., Essex County School of Horticulture	185
	Pearce, A. J., Reading College	185
	Proctor, H., Reading College	185
	Sefton, W. C., Horticultural School, Holmes Chapel	185
	Smallwood, G. Y., F.R.H.S., Queenwood, Broughton, Stockbridge	185

		No. of Marks gained.
135.	Carlyon, C. M., F.R.H.S., Swanley College	180
	Dodd, W. E., Horticultural School, Holmes Chapel	180
	Hicks, W., Russell Gardens, Liskeard	180
	Ingles, M., Essex County School of Horticulture	180
	Lee, J., 292 Atherton Road, Hindley, Wigan	180
	Madelin, M., 71 Earlswood Road, Redhill	180
	Mallard, H. J., County Technical School, Stafford	180
	Murray, E., Reading College and Lady Warwick's Hostel	180
	Rushton, J. C., County Technical School, Stafford	180
	Slade, R., Silverburn, Ormskirk	180
	Smith, F., 3 Harestone Lane, Upper Caterham	180
	Smith, M. M., Swanley College	180
147.	Beckett, W., Horticultural School, Holmes Chapel	175
	Duguid, M., Swanley College	175
	Lyon, R., 19 Barn Street, Strathaven, Lanarkshire	175
	Martin, H., Horticultural School, Holmes Chapel	175
	Nichols, H. R., City Technical School, Oxford	175
152.	Blackshaw, A., Horticultural School, Holmes Chapel	170
	Cole, T., City Technical School, Oxford	170
	Denman, J., Brynbella Gardens, St. Asaph	170
	Gilbey, G., Essex County School of Horticulture	170
	Harrison, F. A., Launton, Bicester, Oxford	170
	Hughes, C. F., City Technical School, Oxford	170
	Hunter, T., Coombe Cottage Gardens, Kingston Hill	170
	Jacobs, L. L., Swanley College	170
	McDonald, A. J., The Gardens, Monteviot, Jedburgh	170
	Matthews, W. A., City Technical School, Oxford	170
	Mitchell, F., City Technical School, Oxford	170
	Moore, W. E., Horticultural School, Holmes Chapel	170
	Pitman, E. B., Old Basford Vicarage, Nottingham	170
	Rigold, S., Swanley College	170
	Sibley, J., The Grove, College Road, Dulwich Common	170
	Sumner, A., Horticultural School, Holmes Chapel	170
	Trollope T., Middleton Park, Bicester	170
169.	Bishop, R., 262 Burrage Road, Plumstead	165
	Brown, H. W., "Salmons," Whyteleaf, Surrey	165
	Donoghue, J. F., Tranby Croft Gardens, Hull	165
	McKechnie, W. C., The Gardens, Ffrwdgrech, Brecon	165
	Pruce, H., Curbridge Road, Witney, Oxon	165
	Reux, F., The Gardens, Drove, Singleton, Chichester	165
	Rolfe, T., Essex County School of Horticulture	165
	Wright, J. R., Chalkpit Cottage, Caterham Valley	165
177.	Allison, W., County Technical School, Stafford	160
	Young, E., The Gardens, The Grange, Kingston Hill	160
179.	Champness, E. H., Haslemere, Park Hill, Carshalton	155
	Dolphin, A., 37 West Row, West Bars, Chesterfield	155
	Evans, W. N., Horticultural School, Holmes Chapel	155
	Hargreaves, J. T., The Ruins, Harwood, Bolton	155
	Head, G. H., The Gardens, Poltimore Park, Exeter	155

		No. of Marks gained.
179.	Holford, G., County Technical School, Stafford	155
	Minty, J., The Gardens, Riverdene, Cookham	155
	Peaples, F. W., Hardy Mill House, Harwood, Bradshaw, Bolton	155
	Townend, J. W., The Cottage, 24 Westcliff Road, Birkdale	155
	Watson, J. W., F.R.H.S., Upper Sleigh Lea, Fulwood	155
189.	Gibson, J., Swanley College	150
	Hough, W., The Gardens, Ryecroft Hall, Audenshaw, near Manchester	150
	Jay, P. C. H., Lancaster, Croft Road, Carshalton	150
	Morrell, K., Swanley College	150
	Powell, E. H., Swanley College	150
	Wilson, T., Elvaston Castle Gardens, Derby	150

Third Class.

195.	Miller, M., Swanley College	145
	Sibley, C., Rutlish School, Wimbledon	145
197.	Heald, C. W., Horticultural School, Holmes Chapel	140
	Jenkins, A. R., County Technical Schools, Stafford	140
	Johnston, M. D., Reading College and Lady Warwick Hostel	140
	Shaw, J., Stermerhill Gardens, Tottington	140
	Taylor, W. R., Woodhatch, Reigate, Surrey	140
202.	Kirkman, A., 303 Stitchmy Lane, Harwood, Bolton	135
	Mackay, M., Swanley College	135
	Miles, H. W., 4 Westend, Witney, Oxon	135
205.	Boorman, H. G., City Technical School, Oxford	125
	Chapman, G. M., Leopold Road, Wimbledon Park	125
	Girling, J. A., Reading College	125
	Hunter, J., 52 Castle Street, Woolton, Liverpool	125
	Jolley, E., 2 Lynwood Villas, Jubilee Road, Waterloo Ville, Hants	125
	Polkinghorne, F. J., Gardens, Polgwin, Bodmin	125
211.	Backhouse, A., City Technical School, Oxford	120
	Lickman, R., Gardens, Coombe House, Kingston-on-Thames	120
	Spencer, J., 40 Lower Church Street, Warwick	120
214.	Field, J. D., Woodstock Road, Witney	110
	Long, H. B., St. John's, Bicester, Oxon	110
216.	Brooks, A., 81 Farnsby Street, Swindon	105
	Goble, W. E., Kingswood Warren, Epsom	105
	Grantham, W., Technical Institute, Aughton, Ormskirk	105
219.	Englefield, G., 22 Cross Road, Wimbledon	100

REPORT ON PEAS AT CHISWICK, 1901.

NINETY-FOUR stocks of Peas were received for trial in the Gardens, and with the exception of Nos. 89 to 94 inclusive, which were sown on April 4, all the other stocks were sown on March 14, on ground that had been deeply trenched and heavily manured the previous autumn. All the stocks were sown thinly, and germinated well, followed by strong sturdy growth, and heavy crops, quite free from fungoid or insect pests. Three meetings were held by the Committee to examine them—on June 20 for the early varieties, July 5 for the mid-season and later ones, and on July 16 for the latest varieties.

F.C.C.=First Class Certificate.
A.M.=Award of Merit.

1. Alderman, **F.C.C.** July 10, 1900 (Sharpe).—See Vol. XXIII., Part 2, page 168. Ready July 1.

2. Blue Auvergne (Sharpe).—Height 4½ feet; haulm and pods deep green; pods in pairs, short, slightly curved, filled with five small white Peas of poor flavour; heavy crop. Ready June 29. Seeds round. A variety not worth garden culture.

3. British Empire (Johnson).—See Vol. XXV., Parts 1 and 2, page 164. Ready June 28.

4. Compactum (Laxton).—Height 2½ feet; haulm and pods dark green; pods single, long, curved, filled with seven large deep green and moderately sweet Peas; heavy crop. Ready July 1. Seeds wrinkled.

5. Danby Stratagem, **A.M.** July 5, 1901 (Carter).—Height 3½ feet; haulm and pods dark green. A larger and later form of the well-known 'Stratagem,' bearing a very heavy crop of delicious Peas. Ready July 5. Seeds wrinkled.

6. Delicatesse (Carter).—Height 3 feet; haulm and pods deep green; pods in pairs, long, narrow, curved, averaging six small pale green and very sweet Peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

7. Duke of Albany (Sharpe).—Not true, and proved to be 'Telephone.' Ready July 1. Seeds wrinkled.

8. Dwarf Gradus (Laxton).—Height 15 inches; haulm and pods dark green; pods single, long, straight, pointed, averaging seven large and beautiful green Peas in a pod; heavy crop. Ready June 21. Seeds wrinkled.

9. Dwarf Mammoth (J. Veitch).—Height 3½ feet; haulm and pods dark green; pods in pairs, long, broad, slightly curved, averaging six large deep green Peas of fair flavour in a pod; very heavy crop. Ready July 5. Seeds wrinkled.

10. Dwarf Telephone, **A.M.** July 5, 1901 (Carter).—Height 1½ foot. A dwarf form of the well-known 'Telephone,' producing a very heavy crop. Ready June 29. Seeds wrinkled.

11. Early Border (Sharpe).—Height 2 feet; haulm dark green; pods paler, in pairs, short and straight, averaging five whitish and rather sweet Peas in a pod; very heavy crop. Ready June 14. Seeds round.

12. Edward VII., **A.M.** June 20, 1901 (Carter).—Height 3 feet;

haulm and pods dark green; pods single, moderate length, straight, handsome, averaging seven medium sized and very sweet Peas in a pod; very heavy crop from the bottom of the haulm to the top. Ready June 20. Seeds wrinkled.

13. King Edward VII. (Cullen).—Height $1\frac{1}{2}$ foot; haulm and pods dark green; pods in pairs, long, straight, averaging eight large green Peas in a pod; heavy crop. Seeds wrinkled. This variety is perfectly distinct from No. 12.

14. Empress (Sharpe).—A good form of 'Ne Plus Ultra.' Ready July 1. A variety under this name was awarded a **F.C.C.** July 20, 1886, from Mr. Eckford.

15. Excellence (Watkins & Simpson).—Height $2\frac{1}{2}$ feet; haulm and pods dark green; pods in pairs, of moderate length, straight, averaging seven large dark green Peas in a pod; heavy crop. Ready July 1. Seeds wrinkled.

16. Fortyfold (Sharpe).—The Committee decided this was 'Champion of England.' Ready June 28.

17. Glory of Devon, **A.M.** July 11, 1899 (R. Veitch).—See Vol. XXIII., Part 2, page 164. Ready July 1.

18. Goldfinder (R. Veitch).—A very good selection of 'Ne Plus Ultra.' Ready July 2.

19. King of the Earlies (Carter).—Height 15 inches; haulm deep green; pods pale green, long, straight, single, averaging six large pale green Peas in a pod; good crop. Ready June 24. Seeds wrinkled. Not a very early variety.

20. Mansfield Show, **A.M.** July 26, 1898 (Wright).—Height $3\frac{1}{2}$ feet; haulm and pods very dark green; pods usually in pairs, long, handsome, averaging seven large deep green and sweet Peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

21. Moorfield Pride (Dickson & Robinson).—A very good stock of No. 1, but earlier. Ready June 28.

22. Prolific Late Marrow, **A.M.** July 5, 1901 (J. Veitch).—Height $3\frac{1}{2}$ feet; haulm and pods dark green; pods in pairs, long, broad, straight, handsome, averaging nine large deep green and very sweet peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

23. Robert Fenn, **F.C.C.** July 22, 1881 (Hurst).—Height 3 feet; haulm dark green, pods a paler green; pods in pairs, short, broad, straight, pointed, averaging five pale green sweet Peas in a pod; heavy crop. Ready July 1. Seeds wrinkled. The pods of this variety did not fill well.

24. Sharpe's Queen, **A.M.** July 5, 1901 (Sharpe).—Height 3 feet; haulm and pods very dark green; pods in pairs, long, broad, straight, averaging seven large deep green and delicious Peas in a pod; very heavy crop. Seeds wrinkled. Ready June 29.

25. Supreme (Sharpe).—Height $5\frac{1}{2}$ feet; haulm and pods deep green; pods in pairs, long, nearly straight, uneven in size, averaging five large green and moderately sweet Peas in a pod; very heavy crop. Ready June 27. Seeds slightly wrinkled.

26. The Herald (Barr).—See Vol. XXV., Parts 1 and 2, page 166. Ready June 28.

27. The King (Watkins & Simpson).—Height $3\frac{1}{2}$ feet; haulm and pods very dark green; pods in pairs, of moderate length, broad, straight, averaging six large deep green sweet Peas in a pod; heavy crop. Ready July 5. Seeds wrinkled.

28. The Major, **A.M.** June 28, 1900 (Hurst).—See Vol. XXIII., Part 2, page 165. Ready June 28.

29. The Sherwood, **A.M.** July 5, 1901 (Hurst, Sutton).—Height 3 feet; haulm and pods deep green; pods in pairs, of moderate length, straight, blunt, averaging six large and sweet Peas in a pod; very heavy crop. Ready June 29. Seeds wrinkled.

30. Telegraph (Sharpe).—Height $5\frac{1}{2}$ feet; haulm and pods light green; pods usually in pairs, long, broad, straight, averaging nine large deep green Peas in a pod; heavy crop. Ready June 27. Seeds wrinkled.

31. Telephone, **F.C.C.** June 27, 1878 (Sharpe).—See Vol. XXV., Parts 1 and 2, page 166.

32. Utility (Watkins & Simpson).—See Vol. XXIII., Part 2, page 165.

33. Veitch's Seedling (J. Veitch).—Height 2 feet; haulm and pods deep green; pods in pairs, short, straight, averaging six large sweet green Peas in a pod; heavy crop. Ready June 29. Seeds only slightly wrinkled.

34. Weston Early (J. Veitch).—The Committee decided that this variety too closely resembled 'Prince of Wales' to be distinct. Ready July 1. Seeds wrinkled.

35. Weston Maincrop (J. Veitch).—Same as 'Ne Plus Ultra.' Ready July 1.

Messrs. Sutton, Reading, sent the following collection of Peas, which are divided into sections, to show how the old standard varieties would compare with those of recent introduction. The trial and comparison proved both valuable and interesting, and was an excellent object lesson. All the stocks were remarkably true.

First Early Dwarf Section.

Standard variety:—

36. American Wonder.—Height $1\frac{1}{2}$ foot; haulm and pods dark green; pods single, medium size, straight, and rather pointed, averaging six moderately large sweet green Peas in a pod; moderate crop. Ready June 19. Seeds wrinkled.

Varieties for comparison:—

37. Little Marvel.—Height 15 inches; haulm and pods dark green; pods in pairs, medium length, broad, straight, pointed, averaging seven large and sweet green Peas in a pod; heavy crop. Ready June 19. Seeds wrinkled.

38. Green Gem.—Height 15 inches; haulm and pods very dark green; pods single, long, broad, and straight, averaging eight large and very sweet deep green Peas in a pod; heavy crop. Ready June 19. Seeds wrinkled.

39. Sutton's Seedling.—Height 15 inches; haulm and pods deep

green; pods in pairs, long, broad, straight, pointed, averaging six large pale green sweet Peas in a pod; heavy crop. Ready June 18. Seeds wrinkled.

40. Sutton's Harbinger, **A.M.** June 20, 1901 (Sutton).—Height 15 inches; haulm and pods very dark green; pods usually single, long, broad, straight, blunt, averaging seven large pale green and remarkably sweet Peas in a pod; very heavy crop. Ready June 13. Seeds wrinkled. This was the earliest Pea in the collection, and is perfectly distinct from Harbinger, awarded a **F.C.C.** in 1872.

41. Excelsior. Height 18 inches; haulm and pods deep green; pods single, long, broad, straight, averaging seven large pale green Peas in a pod; heavy crop. Ready June 19. Seeds wrinkled.

42. The Sherwood.—See No. 29.

43. Chelsea Gem, **F.C.C.** July 1, 1887.—Height 15 inches; haulm and pods deep green; pods in pairs, long, slightly curved, averaging six large and sweet Peas in a pod; very heavy crop. Ready June 20. Seeds wrinkled.

44. William Hurst.—Height 18 inches; haulm and pods very dark green; pods single, long, slightly curved, pointed, averaging six moderately large pale green sweetish Peas in a pod; heavy crop. Ready June 18. Seeds wrinkled.

45. English Wonder.—Height 18 inches; haulm and pods deep green; pods in pairs, of moderate length, curved, averaging six large pale green Peas in a pod; heavy crop. Ready June 20. Seeds wrinkled.

First Early Tall Section.

Standard varieties—Eclipse, Sangster's No. 1:—

46. Eclipse.—Height 3½ feet; haulm and pods pale green; pods usually single, short, straight, blunt, averaging six small whitish Peas in a pod; heavy crop. Ready June 14. Seeds blue, round.

47. Sangster's No. 1.—Height 3 feet; haulm and pods deep green; pods in pairs, short, straight, blunt, averaging seven whitish Peas in a pod; heavy crop. Ready June 14. Seeds round.

Varieties for comparison:—

48. Ideal, **A.M.** June 20, 1901 (Sutton).—Height 3 feet; haulm and pods dark green; pods single, long, broad, straight, averaging seven large deep green and exceptionally sweet Peas in a pod; very heavy crop. Ready June 14. Seeds wrinkled.

49. May Queen.—Height 3 feet; haulm dark green; pods paler, usually single, of moderate length, broad, straight, blunt, averaging six large pale green Peas in a pod; heavy crop. Ready June 14. Seeds wrinkled.

50. Duchess of York, **A.M.** June 20, 1901 (Sutton).—Height 4 feet; haulm and pods dark green; pods single, long, broad, straight, covered with a deep bloom, averaging nine large deep green Peas in a pod; very heavy crop. Ready June 20, 1901. Seeds wrinkled.

51. Empress of India.—Height 3½ feet; haulm and pods deep green; pods single, long, straight, pointed, averaging nine large bright green sweet Peas in a pod; very heavy crop. Ready June 20. Seeds wrinkled.

52. Bountiful.—Height 4 feet; haulm and pods deep green; pods single, long, straight, pointed, averaging nine large pale green sweet Peas in a pod; heavy crop. Ready June 20. Seeds round.

53. Ameer, **A.M.** June 20, 1901 (Sutton).—Height 4 feet; haulm and pods dark green; pods in pairs, long, curved, averaging eight large pale green Peas in a pod; excellent flavour; very heavy crop. Ready June 20. Seeds round.

54. Exonian, **F.C.C.** July 1, 1887.—Height 3½ feet; haulm and pods deep green; pods single, short, straight, and rather pointed, averaging six medium-sized bright green Peas in a pod; heavy crop. Ready June 20. Seeds wrinkled.

Second Early Dwarf Section.

Standard varieties—Advancer, Prince of Wales.

55. Advancer.—Height 2½ feet; haulm dark green; pods pale, in pairs, rather small, straight, averaging six small pale green Peas in a pod; heavy crop. Ready July 1. Seeds wrinkled.

56. Prince of Wales, × × × = Highly Commended, July 5, 1901.—Height 3½ feet; haulm dark green; pods pale green, in pairs, moderate length, straight, averaging four large sweet pale green Peas in a pod; extraordinary heavy crop from the bottom to the top of the haulm. Ready June 29. Seeds wrinkled.

Varieties for comparison:—

57. Favourite.—Height 2 feet; haulm dark green; pods pale, in pairs, short, broad, straight, averaging six large sweet pale green Peas in a pod; heavy crop. Ready June 29. Seeds wrinkled.

58. Nonpareil.—Height 18 inches; haulm and pods dark green; pods in pairs, long, broad, straight, averaging five large deep green sweet Peas in a pod; heavy crop. Ready June 28. Seeds wrinkled.

59. Perfect Gem, **A.M.** July 5, 1901 (Sutton).—Height 2½ feet; haulm dark green; pods paler, long, broad, straight, in pairs, averaging seven large and very sweet pale green Peas in a pod; remarkably heavy crop. Ready June 29. Seeds wrinkled.

60. Dwarf Defiance, **A.M.** July 5, 1901 (Sutton).—Height 2½ feet; haulm and pods very dark green; pods in pairs, long, broad, straight averaging nine large deep green and delicious Peas in a pod; very heavy crop. Ready June 27. Seeds wrinkled.

61. Prizewinner, **F.C.C.** July 5, 1901 (Sutton).—Height 3 feet; haulm and pods dark green; pods in pairs, long, broad, straight, averaging nine large deep green Peas of fine flavour in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

62. Productive.—Height 1½ foot; haulm dark green; pods paler, single, long, nearly straight, pointed, averaging six large pale green Peas in a pod; heavy crop. Ready June 30. Seeds wrinkled.

63. Carter's Daisy, **A.M.** June 25, 1895.—Height 2 feet; haulm and pods deep green; pods in pairs, long, broad, straight, pointed, averaging seven large pale green and very sweet Peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

64. Stratagem, **F.C.C.** July 7, 1882.—Height 2½ feet; haulm and

pods dark green; pods in pairs, long, straight, pointed, averaging eight large deep green Peas of good flavour in a pod; heavy crop. Ready June 28. Seeds wrinkled.

Second Early Tall Section.

Standard varieties—Hundredfold, Prizetaker, Duke of Albany:—

65. Hundredfold.—Height 6 feet; haulm and pods deep green; pods in pairs, moderate length, slightly curved, pointed, averaging seven large green Peas of fair flavour in a pod; heavy crop. Ready June 29. Seeds round.

66. Prizetaker.—Very similar to No. 65, but not so good in flavour. Ready June 29. Seeds round.

67. Duke of Albany, **A.M.** July 5, 1901 (Sutton).—Height 6 feet; haulm and pods very dark green; pods in pairs, long, broad, slightly curved, handsome, averaging nine large deep green and very sweet Peas in a pod; very heavy crop. Ready June 27. Seeds wrinkled.

Varieties for comparison:—

68. Centenary, **A.M.** July 5, 1901 (Sutton).—Height 5½ feet; haulm and pods dark green; pods in pairs, long, broad, straight, handsome, averaging eight very large and very sweet Peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled. This variety had the largest pods in the collection, and will prove a fine exhibition variety.

69. Prince of Peas.—An improved 'Ne Plus Ultra.' Ready July 1. Seeds wrinkled.

70. Alderman, **F.C.C.** July 10, 1900.—Height 6 feet; haulm and pods dark green; pods in pairs, long, broad, straight, averaging nine large deep green sweet Peas in a pod; very heavy crop. Ready July 1. Seeds wrinkled.

Medium Section.

Standard varieties—Dr. McLean, Yorkshire Hero:—

71. Dr. McLean.—Height 2 feet; haulm dark green; pods paler, in pairs, long, slightly curved, averaging eight whitish Peas of good flavour in a pod; very heavy crop. Ready July 5. Seeds wrinkled.

72. Yorkshire Hero.—Height 18 inches; haulm and pods deep green; pods in pairs, short, thick, averaging six large whitish and very sweet Peas in a pod; heavy crop. Ready July 1. Seeds wrinkled.

Varieties for comparison:—

73. Masterpiece.—Height 3 feet; haulm and pods dark green; pods in pairs, pods long, broad, straight, pointed, averaging ten large rich green and sweet Peas in a pod; heavy crop. Ready July 5. Seeds wrinkled.

74. Best of all.—Height 3 feet; haulm and pods dark green, in pairs, long, broad, straight, averaging seven large deep green Peas in a pod; heavy crop. Ready July 5. Seeds wrinkled.

75. Peerless, **A.M.** July 10, 1900.—Height 3 feet; haulm and pods dark green; pods in pairs, long, broad, slightly curved, averaging eight large deep green and very sweet Peas in a pod; heavy crop. Ready July 5. Seeds wrinkled.

76. Magnum Bonum.—Height 2 feet; haulm and pods deep green; pods in pairs, long, straight, averaging six large green Peas of good flavour in a pod; heavy crop. Ready July 1. Seeds wrinkled.

77. Eureka.—Height 2½ feet; haulm and pods dark green; pods single, long, straight, pointed, averaging seven deep green and sweet Peas in a pod; heavy crop. Ready July 10. Seeds wrinkled.

78. Prolific.—Height 2 feet; haulm and pods dark green; pods single, long, straight, pointed, averaging six large green Peas in a pod; heavy crop. Ready July 9. Seeds wrinkled.

Main Crop and Late Section.

Standard variety—Walker's Perpetual:—

79. Walker's Perpetual, **F.C.C.** August 9, 1881.—Height 3 feet; haulm and pods deep green; pods usually single, moderate length, blunt, averaging five medium-sized pale green and sweet Peas in a pod; heavy crop. Ready July 10. Seeds wrinkled.

Varieties for comparison:—

80. Sutton's Perfection.—Height 2 feet; haulm and pods dark green; pods in pairs, long, straight, pointed, averaging eight large dark green sweet Peas in a pod; heavy crop. Ready July 8. Seeds wrinkled. This variety is quite distinct from 'Veitch's Perfection' which received an **A.M.** July 14, 1897.

81. Exhibition.—Height 4 feet; haulm and pods dark green; pods single, very long, straight, pointed, averaging nine large deep green Peas in a pod; heavy crop. Ready July 6. Seeds wrinkled.

82. Sutton's Perpetual.—Height 3½ feet; haulm and pods dark green; pods single, long, straight, pointed, averaging six large green Peas in a pod; heavy crop. Ready July 9. Seeds wrinkled.

83. Continuity, **A.M.** July 9, 1898.—Height 4 feet; haulm and pods dark green; pods in pairs, long, straight, pointed, averaging seven large deep green Peas in a pod; heavy crop. Ready July 10. Seeds wrinkled.

84. Royal Jubilee.—Height 4 feet; haulm and pods deep green; pods in pairs, long, slightly curved, pointed, averaging six large green sweet Peas in a pod; heavy crop. Ready July 10. Seeds wrinkled.

85. Matchless.—Height 4 feet; haulm and pods dark green; pods in pairs, long, pointed, averaging eight large deep green Peas in a pod; heavy crop. Ready July 8. Seeds wrinkled.

86. Conqueror.—Height 2½ feet; haulm and pods dark green; pods in pairs, short, blunt, averaging five very large sweet green Peas in a pod; heavy crop. Ready July 9. Seeds wrinkled.

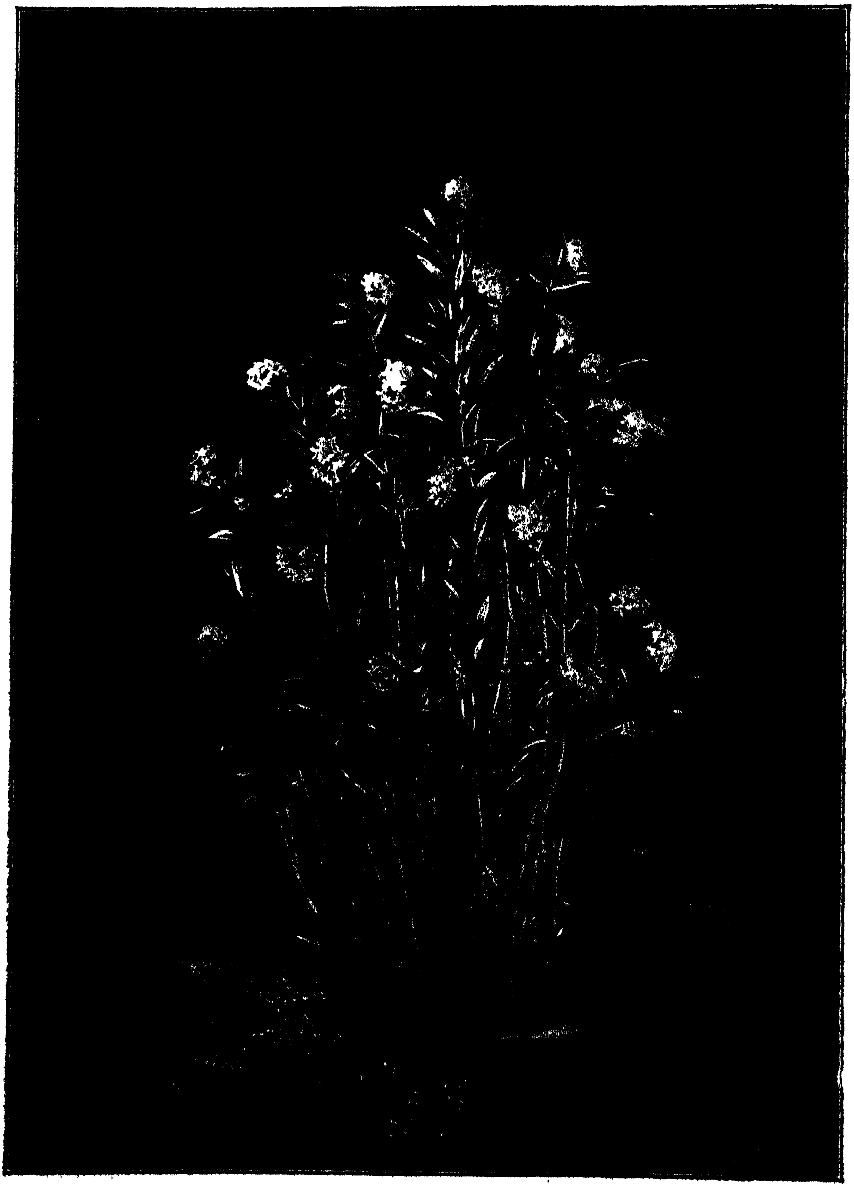
87. Late Queen.—Height 4 feet; haulm and pods dark green; pods in pairs, moderate length, straight, blunt, averaging seven large deep green and very sweet Peas in a pod; heavy crop. Ready July 14. Seeds wrinkled.

88. Autocrat, **F.C.C.** July 10, 1885.—Height 4 feet; haulm and pods dark green; pods single, moderate length, straight, blunt, averaging six large green and very sweet Peas in a pod; very heavy crop. Ready July 15. Seeds wrinkled. This is still one of the best late varieties.

89. Tree Pea Eccentric (Boody).—This proved to be the 'Crown' or

'Mummy' Pea, a useless variety growing to a height of 5 to 6 feet, with a fasciated stem, producing its crop of pods at the apex, which are small, and the Peas of very poor flavour. Seeds round.

90 to 94. Five unnamed (Eckford).—All these were from Culinary Peas × Sweet Peas. There was no apparent difference in any, all growing to a height of 5 feet, producing similar white blossoms, followed by small pods containing five Peas of rather poor flavour. The haulm was like that of the Culinary Pea, with extraordinary long tendrils.



EPIDENDRUM CLAESIANUM. (*Gardeners' Chronicle.*)

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PARTS II. AND III.

NEW PLANT.

NOTE BY DR. MAXWELL T. MASTERS, F.R.S.

Erigeron neomexicanus. Asa Gray.*—We are indebted to Mr. Heinrich Henkel, of Darmstadt, for a specimen of this plant which differs considerably from most of the species in cultivation. It is a bushy annual or perennial, 12–18 inches high, slightly hispidulous, with striate, angular, much-branched stems. The lower leaves are on long stalks, oblong, remotely pinnately lobed, the lobes obovate obtuse, nearly or quite entire, the terminal lobe toothed. In the cauline leaves the lobes are deeper and narrower, almost linear. Flower-heads solitary at the ends of the branches, nearly 3 cent. across. Bracts of the involucre linear, with a purple midrib. Ray florets white, linear, spreading. Disc flattish, with very numerous yellow tubular flowers; pappus plumose. The plant is a native of hill-sides in New Mexico and Arizona. It was collected for Mr. Henkel by Dr. C. A. Purpus, at an elevation of about 7,000 feet, so that it is likely to prove hardy.—*M. T. M.*

* "Erigeron neomexicanus," Asa Gray, *Proc. Amer. Acad.* xix. 2. "A foot or two high from a biennial or winter annual root, leafy, paniculately branched, hispidulous or hispid, with spreading bristly hairs; divisions of the cauline leaves 3 to 9, linear or linear spatulate obtuse, of the radical shorter and broader; rays white or purplish tinged, narrowly linear, 4 or 5 lines long."—A. Gray, *Synoptical Flora*, vol. i. part 2 (1884), p. 219.

ROYAL PARKS, ENGLAND: MANAGEMENT AND ORGANISATION.

By Colonel WHEATLEY, C.B., R.E., Bailiff of the Royal Parks.

[June 18, 1901.]

In explanation of, and apology for, my appearance before you to-day though not a member of the R.H.S., I may say that for more than twenty-two years I have been bailiff of the Royal Parks, and, consequently, during that period have had control, under H.M. Office of Works, of probably the largest and most important group of public parks in the world. It has been my custom for a long while to visit at intervals as many as possible of the best public and private parks and gardens in the country with some of the members of our staff, and last autumn your president, Sir Trevor Lawrence, was kind enough to show us over his beautiful and interesting place near Dorking. Shortly afterwards he asked me to give a lecture, or rather, perhaps, I should say, to read a short paper in the ensuing season on the work done in the Royal Parks in and round London. I pointed out that we did not profess to be scientific botanists or experts as is the case with so many of the members of this Society, that our business was rather to utilise the labours of others—the knowledge and experience of the great botanists—and present the results to the general public in as attractive a form as possible: that ours was, in fact, what may be described as the decorative as distinguished from the scientific aspect of horticulture and arboriculture. I was assured that a scientific lecture was in no way desired, and that the object was rather to circulate some knowledge of our work among the large number of members of the Society all over the country, who do not lay claim to the distinction of botanical experts. I have obtained notes of our work from Mr. Browne, Superintendent of Hyde, St. James's and Green Parks, and Kensington Gardens; from Mr. Jordan, Superintendent of Regent's Park, Mr. Gardiner of Hampton Court, and Mr. Webster of Greenwich Park; to all of whom I am greatly indebted, as also to my colleague, Major Hussey, who has assisted in collating the information.

Our principal work, as you will understand, has to be carried on in the smoke, fog, and dust of London, which handicaps us greatly, prevents our attaining such perfection of many flowers and trees as is to be witnessed in the purer air of the country, and prohibits the growth altogether of many sorts. Violets, as you know, will not flower at all in London, and Conifers are hopeless. We have of late years practically given up attempting to grow Horse-chestnuts even, for though there are splendid specimens of older trees to be seen, the air of London seems to have got so much more deleterious in later years that the young trees coming into leaf so early appear to be quite unable to struggle against the climate. The Plane, of course, is, *par excellence*, the tree for smoke and fog, owing not merely to its shedding its bark, but to the fact that it comes into leaf so late when the climate is less trying.

Another tree that seems to defy the climate of London as well as the Plane is the Poplar, and especially the Canadian Poplar, of which we

FIG. 155.—THE DELL, HYDE PARK.

have planted large numbers in recent years. On Primrose Hill, one of the very worst places I know for trees even in London—a stiff cold clay

and fully exposed to bitter north-east winds—we planted a large number about eighteen years ago, and the way they have grown and flourished is most remarkable. I confess, however, I have a great dislike to them as trees. After the age of about twenty years they become very unsightly and the foliage gets very ragged. I think they should only be used as nurses, or where it is desired to obtain a screen very rapidly, in which capacities they are invaluable. Other trees very valuable in London are different varieties of Lime and Ash, the White-beam (*Pyrus Aria*), the Service-tree (*Pyrus domestica*), the Ailantus, and many varieties of the Acer. The Elms, both English and Scotch, do very well, but the English Oak is little good, though the Turkish variety does very well in many places. A tree that ought to be planted in London a great deal more is the Tulip-tree (*Liriodendron tulipifera*). We have a few fairly good specimens in Kensington Gardens, but it is a tree which has been generally much neglected.

Another excellent as well as beautiful town tree which has been even more neglected is the Ginkgo or Maidenhair-tree. On an occasion of this kind I can do no more than glance at a few of the trees we use and ought to use in the parks of London.

In a public, as distinguished from a private, park or garden, it is expected that there shall be a constant succession of flowers from early spring to late autumn; that the beds, as far as possible, shall never be empty, involving all being filled twice, and in many cases three, four, and even five times, during the year. If a bed fails it cannot be left to itself as may be done in a private establishment, and it is no uncommon thing for a bed to be cleared out and refilled entirely before nine in the morning.

To commence with our spring gardening, directly the last summer crop is out, all the beds are manured and trenched, the bulbs are put in with a trowel in November, and no further attention paid to them except, perhaps, a slight dressing of soot.

A large number of new bulbs are purchased every year; the quantity required may be imagined when I tell you that to fill some of our beds 4,000 Tulips are required, and from 2,000 to 3,000 Hyacinths. In the case of the beds in Park Lane new bulbs entirely are necessary. New and old cannot be mixed, as the latter come into flower so much earlier than the former, and the result is that the cost of our bulbs in Park Lane alone is usually between £300 and £400 each season.

I may here mention that we have always to take out our bulbs before they have properly ripened and died down in order to get in our first summer crop, and consequently we lose a large number that might otherwise be saved. Every care, however, is taken to preserve them. They are arranged in shallow trays in a dark, well-ventilated shed, and in the case of Tulips they are covered with ashes to check evaporation during the summer. These old bulbs are used principally next season for herbaceous borders, &c.

Of late years we have largely extended the system of planting bulbs in the grass, in which way we get our earliest flowers. Amongst these should be named Crocuses, Star Narcissi, Daffodils, which grow and spread vigorously year by year without trouble or expense.

Winter Aconites, Snowdrops, Leucojum, Siberian and Spanish Squills,

the Grape Hyacinth, and Fritillarias are all most valuable in this way. The one great drawback to this kind of gardening is that the grass cannot be cut until the bulbs have completely—or almost completely—died down, and the consequence is that mowing must be deferred till quite late in the season, and when it is done the patches are brown and unsightly. I should say that by planting a variety of bulbs in the same plot we can get a succession of flowers lasting, perhaps, seven weeks, *e.g.* Crocus, Star Narcissus, early Tulips, later Tulips (such as Golden Eagle), and Poet's Narcissus. A great consideration for spring gardening is the collection of flowering shrubs and trees to be selected both for flowers and foliage, among which we may especially mention Forsythias, Weigelas, Lilacs in great variety, Guelder Rose, Coral-flowered Apple and Siberian Crab, Brooms, Amelanchiers, the Bird Cherry, Philadelphus, golden Privet, Dogwood, Buckthorn, *Syringa Emodi*, to say nothing of Azaleas and Rhododendrons, with others too numerous to mention.

The effect may be much enhanced by careful attention in planting to secure a proper combination of the different colours of foliage. You may have observed in Kew Gardens the very beautiful effects produced by what they term their "coloured shrubberies." Care should, I think, be taken to get the lighter foliage in front, and the darker ones, such as Purple Hazel, *Prunus Pissardi*, &c. at the back.

It will, I dare say, have been noticed by many of you, that, during the last twenty years, we have altogether changed the style of bedding in the Royal Parks generally; *e.g.* twenty years ago in Park Lane the summer bedding consisted almost entirely of Pelargoniums, with border of Iresines and Lobelia, &c. We have now to a great extent discarded the use of Pelargoniums for bedding out. We have instead an endless variety of hardy, half hardy, and exotic plants, entailing in their cultivation much more labour and expense. We have also almost entirely discarded carpet bedding, though occasionally we prepare two or three with a view to pleasing all tastes, and of showing what was in former times a favourite style of gardening. We regard carpet bedding, as most people probably now do, as a very inartistic and unnatural style as well as very expensive. I remember, I think in the year 1880, having the number of separate plants in our carpet beds counted. There were upwards of 150,000, and among them there were upwards of 27,000 Alternantheras.

The number of beds that have to be filled, many of them several times over, as before said, is very large; to give some idea of the amount of material of some kind or another that has to be produced, I may say that in the Central Parks the number of beds is approximately 215, in Regent's Park 98, and in Hampton Court Gardens 184, besides an enormous number in other parks and gardens. To fill all these, where the amount of money available is limited, involves careful consideration, and any system that will enable us to show a mass of colour at a small expenditure of money and labour deserves attention. In illustration I may mention a large circular bed on the north side of Rotten Row, which for many years has been filled with purple *Epilobium angustifolium*, known as the French Willow or Willow herb, and adjoining it is a similar bed, filled with *Lythrum roseum* or Purple Loosestrife. These were put in some seven or eight years ago, nothing has been done

to them beyond manuring, and they have gone on improving in a remarkable manner till they are quite a feature each summer, and for spring effect the same beds can be filled with Tulips or

FIG. 156.—AT HAMPTON COURT

other bulbs. The effect might be much enhanced by having a third bed filled with the white *Epilobium*, which, however, is a more difficult variety to obtain and is not such a strong grower. A fourth bed of similar

character might be added filled with *Lysimachia*, either *vulgaris* or *thyrsiflora* or *punctata*, all of these being yellow, so as to get a contrast of colour with the other beds. I merely mention this as showing what

may be done at very small expense with these common pretty old flowers, of which so little use seems now to be made. Another way of getting foliage beds at trifling expense is to plant a number of young Ailantus—

say in one bed—Paulownias in another, and Golden Catalpas in a third. Every year cut these down close to the ground, and in five or six years the gigantic leaves that will be thrown up each season are astonishing. This has been done with great effect in Kew Gardens, and may also be seen in the Regent's Park.

Another great change has taken place which has no doubt been noticed by many of you, and that is the system of plunging in the turf. I will hardly go so far as to say that we originated it, but we have certainly greatly developed it, and I venture to think have brought it to a pitch of perfection that I seldom, if ever, see elsewhere. Mr. Browne, the superintendent of our Central Parks, has largely the credit of first bringing it prominently into notice.

I think it gradually arose somewhat in this way. We had noticed that in private gardens the beds as a rule were insufficiently filled, and that the earth was too visible. We adopted the system in most of our beds of having a groundwork, say of Violas or Creeping Jennies or Alternanthera, or something of that kind, and it was obvious that things planted in this groundwork showed up much better than the same things planted in the naked soil. It then occurred to us that the turf afforded an admirable groundwork out of which these plants might come, and that it was there ready for us without further expense or trouble. We have done a good deal in this way, but I am satisfied that we have by no means reached or realised all or the best of the effects that may be obtained under this system.

One of the latest developments of the idea may be seen, or will be seen, unfortunately rather late in the season, in the Regent's Park, where we now plunge out Hydrangeas on a very considerable scale. Our energies in this direction are, of course, bound and circumscribed by the difficulty of finding houseroom in the winter for all these pots and tubs, and for all our sub-tropical specimens, and though we usually build at least one or two new houses every year in one or other of the Royal Parks, they are no sooner completed than it has been found that every inch of space has been occupied, and the wonder is where everything was housed previously. I must say a few words on one of the most beautiful and striking of our spring or early summer shows, and that is the hybrid Rhododendrons and Azaleas in Hyde Park. Many people appear to suppose that they remain there and flower year after year. As a matter of fact, although the common Ponticums do well enough and go on flowering for an indefinite number of years without being changed, comparatively few of the hybrids will flower more than one year if left in the smoke and fog of London. Nine-tenths are changed every year. By an arrangement we have had for some sixteen or seventeen years with Mr. Anthony Waterer, of Knaphill, a large number that are really well set in the autumn are moved and put together for us and are brought up to London, usually in the beginning of April. The old ones are taken back to Knaphill and put into hospital. As a rule they do not flower again for several years, and may never do so. It is an appalling illustration of the deleterious effects of the climate of London on vegetable, to say nothing of animal, life.

I remember some seven or eight years ago, after Mr. Anthony Waterer had finished bringing up to town the usual collection of Rhododendrons and

Azaleas, he wrote to tell me he would send us an extra plant in the shape of the finest specimen of a "Michael Waterer" he had ever produced, if

FIG. 158.—IN KENSINGTON GARDENS.

we would give it a special position close to the railings on the north side of Rotten Row. This we did, and a splendid specimen it was, some

9 feet or 10 feet high, and 7 feet or 8 feet across, but the remarkable thing was the way in which it was absolutely smothered in bloom. Mr. Waterer remarked to me that if we offered him £1,000 he could not let us have another like it. Well, two years afterwards, when at Knaphill, about Whitsuntide, I inquired if I could see my old friend which had since been in hospital. I was told I could do so, but when we met it was a positive shock to me. He had been cut back to a fourth of the size he had been when I last saw him. He had next to no bloom on him, and I would not have had him back in Hyde Park as a free gift. I have told you this story merely as illustrating the difficulties and expense under which gardening in London fogs is carried on.

There are another class of plants which have come much into prominence and public favour recently, and which are specially valuable for the plunging style of gardening, which of late years we have gone in for so largely; I allude to Bamboos, which specially lend themselves thereto, apart from the very beautiful Bamboo gardens which may be formed in suitable places. The first garden of the kind I saw was at Shrubland Park, Lord De Saumarez's beautiful place in Suffolk. A very successful one has also recently been made at Kew, which doubtless is known to many, if not most of you. I cannot call attention in any way to Bamboos without bringing in the name of my old friend, Mr. Mitford, who was for many years secretary of the Office of Works, and did so much to initiate and encourage the numerous changes and improvements in gardening in the Royal Parks which have taken place in the last twenty years. At his place, Batsford Park, Glos., he has formed one of the most beautiful and interesting wild gardens in the world, and in this he has given special attention to Bamboos and their capabilities. In the latest edition of Mr. Robinson's "English Flower Garden" is a long account of the varieties of Bamboo, which I think I am right in saying was contributed by Mr. Mitford.

I do not, however, call your attention to Bamboos with a view to the formation of Bamboo gardens, for I much doubt if we shall ever succeed in producing a really good Bamboo garden in the London parks, owing to the terrible fog and climate generally, even though they can be grown successfully and kept out all the year so near London as Kew Gardens. We have certainly not so far succeeded in keeping any out all the year round in good health and strength, except *Metake* and *Simoni*, and even these all through the spring and early summer remain brown and emaciated after the winter fogs, and only recover themselves later in the year, when, unfortunately for us, everyone is going or gone out of London.

If, however, a collection of the more tender Bamboos be kept in houses during the winter, such as *aurea*, *nitida*, *viridi-glaucescens*, *Quilioi*, *nigra*, *nobilis*, *falcata*, and *anceps*, which, by the way, seems more likely to become gradually hardy than any of them, excellent effects may be produced in summer by plunging them out in conjunction with other plants. One of the most beautiful effects I know has been that of groups of Bamboos interspersed with and behind a large number of Agapanthuses in full flower, which was to be seen last year and the year before in the Regent's Park, and which I hope you will be able to see later on this

summer. There are endless other groupings to suggest that can be arranged in conjunction with Bamboos, and it is one of those ideas which in my opinion we are only just beginning to understand and develop.

FIG. 159.—BAMBOOS IN GREENWICH PARK.

There is another subject of quite as much importance in public parks as either horticulture, strictly so called, or arboriculture, and that is the formation and maintenance of grass in proper condition, whether on kept

lawns or open land. The difficulty and expense of doing this, of course, far exceed anything called for in private establishments, owing to the wear and tear to which it is subjected. Every year there are considerable areas to which the grass must be brought back, so to speak. The best way of doing this is unquestionably to pick up the surface and sow with grass-seeds. It forms the best and most permanent turf; but, of course, several years must elapse before the grass becomes established and can be used by the public. There are considerable spaces where we cannot shut up the land for years, and in these cases turf must be laid. And, in this connection, I should like to bring before you an interesting fact that experience has borne in upon us.

We used formerly to purchase large quantities of the best possible turf from different parts of the country, in the neighbourhood of London, and lay it down where required in the London parks. We found, however, that country turf would rarely stand more than one season in London, and we have adopted the system of stripping turf from some open part of each park and laying it down where required, the portions that have been stripped being, as soon as possible, sown down with grass-seeds. Turf moved in this way from one part to another of the same park will stand almost indefinitely. There are also places where fresh turf has to be laid down every season, and, in these cases, at times we still purchase turf in the country, knowing it is not expected or required to stand for more than one season. We do not, of course, like to strip more turf off the park land than we are absolutely obliged to do. This brings us to the interesting question of why turf brought from the country will not stand in London.

I have more than once alluded to the deleterious effect of the London climate on so many forms of plant life; but this, in my opinion, is not applicable to grass, or, rather, it is not applicable to the special grasses that are found in London turf. They are, in fact, quite at home in the climate of London. So far from being a bad climate for grass, it is a decidedly good one, owing very probably to the amount of soot deposited on it, than which there is, as you know, no better dressing for grass, and the causes must be sought elsewhere. I took up this question of grass and grass-seeds many years ago, and consulted my old friend, Mr. Carruthers, who is probably well known to most of you, and who is an acknowledged expert on the subject. The conclusion arrived at as regards the failure of country grass to stand in London is, in the first place, that the mere *change* of soil and climate is injurious, but that above and beyond that is the fact that the plants composing the turf brought from the country differ very largely from those that are indigenous to and flourish in London. Some years ago Mr. Carruthers was good enough to analyse for us the grasses on a piece of turf brought, I think, from the neighbourhood of Mitcham, and of another piece taken from one of the London parks. I have not the results of the analysis by me, but they were very striking.

It may, perhaps, be of interest to you to know that we have a very strict system under which we purchase our grass-seeds. Mr. Carruthers, many years ago, prepared for us a list of seeds suitable for the London parks, and also drew up a specification to accompany all tenders for the

same, a copy of which I should be pleased to supply to any member of the Society interested in the subject, which is, I am inclined to think, of more importance than is generally recognised. I will only say now that we have each seed delivered separately in bulk after the acceptance of a tender, and, from the centre of one or two sacks of each variety, a sample is taken and sent to Mr. Carruthers, as Consulting Botanist of the Royal Agricultural Society, for analysis and report before final acceptance. If the result of the germination is above the standard named in the specification, we pay for that seed proportionately higher than the price named in the tender for that particular seed; where it is lower we proportionately reduce the payment. Of course, if the germination be really bad we reject the seed altogether.

Two or three years ago I was instructed to lay down again to grass about 45 acres in Queen's Park, Holyrood Palace, from which the grass had entirely disappeared, owing to neglect and continual use of the land for drill and for football and other games.

It was decided to plough the land up, and I consulted Mr. Carruthers as to the seeds it would be desirable to sow. I found he was able to supply me with a list of all the grasses found in the turf there from an analysis he had made a short time before.

We availed ourselves of this information, and the result has been highly satisfactory, as I think will be apparent to any one who inspects it, having regard to the fact that the land was only sown in the spring of 1899. Indeed, the way in which the grass has rooted and spread is quite remarkable. Mr. Carruthers advised us to sow some rape-seed at the same time, in view of the likelihood of a dry, hot season, so that it might shelter the young grass for the first two summers, and keep it to some extent moist. It was fortunate we did this, for the summer of 1899 was very hot and dry, and but for the rape it would probably have been quite burnt up. The appearance of the land when the rape grew up was curious, and the residents in the neighbourhood seemed to think we had devoted the land to a market garden. The rape has now, of course, entirely disappeared, and the grass seems able to take care of itself.

It is found, I believe, analysing turf generally, that not more than five or six different varieties of grass exist in it, and that, whatever seeds may be sown, after a few years only what may be termed the indigenous grasses remain permanently. It may be asked, then, why it is the custom to sow, say, twice as many varieties of seeds as will ultimately remain there. The answer is that it is not well to sow what will form the permanent plants too closely, but to let others temporarily nurse them and be gradually edged out and die off as the roots of the indigenous grasses spread and strengthen.

I should like to say a word specially to the owners, *qua* owners, of parks and gardens, large and small, as well as the managers of our public parks, and that is, that I think they should encourage and even require their superintendents and head gardeners to go about the country as much as possible and see what is being done in places other than those of which they have the charge—wherever possible, too, they should take the opportunity of seeing what is being done abroad, not only on the Continent, but even in America. We do this largely. Our superintendents,

I am sure, much enjoy and appreciate it, and always tell me they have gathered some new ideas.

I have been often greatly surprised, when visiting some of the well-known parks and gardens of England, to find that the head gardener knew little or nothing of other well-known places even in the same county, and, though his own particular work might be very well carried out, had few ideas beyond what was to be found in his own surroundings.

The responsibility for this lies doubtless less upon them than upon the owners or managers of the parks, public or private, as the head gardeners can hardly be expected to travel about the country altogether at their own expense.

In conclusion, I should like to say that in the management of public parks there is an immense variety of questions affecting the public who frequent them, irrespective of horticulture and arboriculture, but in their way of quite as much importance and calling for quite as much attention and special knowledge.

I allude, for example, to the formation of rides, roads and footpaths, on which alone a treatise might be written showing the different treatment called for in almost every park, and the difficulty of meeting the demands of the public for perfection in all.

A subject which interests almost if not quite as many people in the London Parks as horticulture is that of the birds, especially the collection of wildfowl, in St. James's Park and elsewhere. I am not going to trouble you with many details regarding them, but may mention that the cormorants, which have been a great interest to the public for many years, were taken by myself from nests (if they can be called nests) on the Farne Islands, where I went with our invaluable birdkeeper, Reilly, who, I regret to say, died last year, and was a grievous loss to us.

We brought away at the same time a number of kittiwakes, terns, guillemots and puffins, but regret to say we lost them all, and I fear there is no doubt the last two at any rate can never be acclimatised, so to speak, in London. Even in the Zoological Gardens they have never succeeded, so far as I know, in keeping them for more than a very short time. The experiments we have made, our failures and successes in the introduction of birds of all kinds and their preservation in the London parks, might form the subject of a paper by itself.

Another very interesting question is the treatment of the verges of the lakes and ponds, and the difficulties we meet with in dealing with them in an artistic manner, owing to the fact that the public will not be satisfied unless they can get down to the water itself, to boat, bathe, swim their dogs, and sail their model yachts. Complaints in these respects are common, regarding, *e.g.*, the banks of the Serpentine and the lake in Regent's Park, from people of artistic temperament, who fail to realise the conditions with which we have to deal.

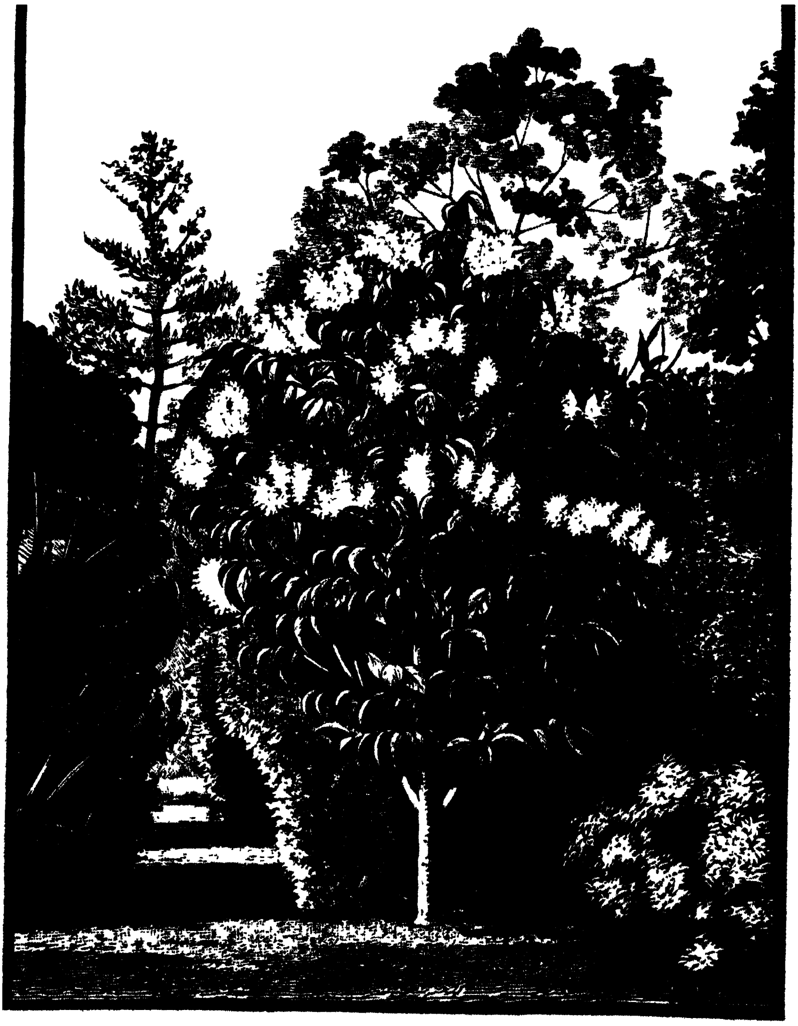
The provision of seats and chairs is quite a special branch. In the Central Parks, *i.e.* Hyde Park, St. James's, Green Park, and Kensington Gardens alone, we have between 30,000 and 40,000 chairs, and in dealing with them an amount of attention and organisation is required which is perhaps not generally and fully realised. Questions of trespasses and boundaries, particularly in historical estates like the Royal Parks, involve

continual inquiry and investigation. In a hard winter the regulations and precautions to be taken in respect to skating, especially where the

FIG. 160.—THE LAKE, GREENWICH PARK.

water is deep enough to drown, are very anxious matters, and I could tell you many interesting anecdotes in relation thereto. There is the great question of policing the parks and dealing with the public and offences

against the regulations, especially in places like Hyde and St. James's and Green Parks, remaining open after dark, which again involves the large question of the extent and mode of lighting, and the different systems to be adopted. Out of the large number of papers passing daily through my hands, I really do not think that one of them in ten has any direct relation to either horticulture or arboriculture. I do not propose to enter into these at all, and perhaps they would hardly be suitable in a lecture to the Royal Horticultural Society, but I should like to be allowed to draw your attention to the fact that they exist, and their consideration constitutes a large proportion of our duties.



THE PROPAGATION OF PLANTS, WITHOUT SEEDS.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

Lecture to the Students at the Society's Gardens, June 12, 1901.

The reproductive system "proper" of plants consists, of course, of their flowers and the resulting fruits and seeds. These have a more or less great facility for distribution, thereby enabling the descendants to escape to a distance from the original habitat of their parents.

Seed, however, is largely supplemented, and indeed in many cases entirely superseded, by methods of propagation carried on by the vegetative system of flowering plants. We are all familiar with runners, stolons, bulbs, corms, &c., as different methods, which plants have acquired, by means of which they can reproduce themselves independently of seed.

Moreover, it has been noticed that when a plant has been long propagated entirely by these structures, it appears often to lose the faculty—whether temporarily or permanently it would be hazardous to conjecture—of producing seed. This is the case with the Horse-radish in our gardens. It is said to have been so with the cultivated Saffron Crocus; and to a large extent it is so with the wild Lesser Celandine, &c.

Another noticeable feature is that although the particular form, say, bulb, corm, &c., may be normally subterranean, the power to produce them resides in the living protoplasm of the whole plant; so that we sometimes find tubers, bulbs, and corms on the aërial parts of plants.

The question now arises, what were the surrounding conditions which induced these various forms of propagative structures to occur?

In former days, botanists were content to describe them and say that the common blue Iris or Garden Flag was characterised by having a rhizome; Primroses, by a rootstock; Crocuses, by a corm, &c. And that was considered sufficient. But evolution has come to the front, and we do not now rest satisfied with facts alone; we want to find out the causes of their existence; as Bacon said: "The End of our Foundation is the knowledge of causes and secret motions of things."

The questions, then, are, how the environment acts upon plants, and how they respond to it. We cannot always be sure that we are right, but we can frame hypotheses, to be discarded as soon as more certain knowledge is obtained.

Let us take the various organs of a plant in order—roots, stems, and branches, buds and leaves, and we will see how they can depart from their normal functions and become means of propagation respectively.

Roots and Stems.—I will here quote what I have elsewhere written upon the possibility of interchanges between the functions of these organs.*

That roots and stems are structures differentiated from a common and fundamentally identical type is obvious from such facts as the following: Every detail in the histological elements of the two structures can,

* *Origin of Plant Structures*, p. 179.

speaking generally, be paralleled one with another, allowing for the total arrest of one or more elements in certain cases. Stems can form roots when placed in the same conditions in which roots are formed, viz. darkness and moisture. Aerial roots can take on the functions of stems; and roots formed underground can become stems and branches when exposed to air and light.

Now the fact I wish to emphasise is, that these differences between stems and roots are, as a rule, the direct results of the aërial and subterranean conditions of their normal existence respectively, and that when a subterranean root becomes superficial or aërial it at once tends to approximate to the character of a stem; and if a normally aërial stem is made to grow underground, it in turn tends to acquire the characters of a true root. Not only does Nature often supply us with illustrations of these changes, but experiments distinctly verify this assertion.

When the roots of Elms, Poplars, Hawthorns, Horse-chestnuts, &c., get exposed on the sides of banks, they constantly send out a perfect forest of leafy shoots.

The following experiment, recorded by Dr. Lindley, will also illustrate this. A young Willow-tree had its crown bent down to the ground; this was covered with earth, and soon emitted an abundance of roots. The tree-roots were then carefully removed from the soil and the stem inverted. The roots now became branches and emitted buds, and the tree grew ever afterwards upside down.

Judging by these experiences, it would seem that when roots are near the surface, or exposed to light, these conditions appear to act as causes or stimulants to the production of leaf-buds.

But if the aërial portions of a tree—say an Elm—be cut down, then the vitality of the roots asserts itself in the production of buds from the roots; such not having been previously exposed nor buds formed.

This property can be taken advantage of; so that plants can be propagated by pieces of the roots, as of Peaches, Plums, &c., which readily give rise to buds.

In fact, in the last named of the genus *Prunus*, it has become a fixed habit, the production of shoots from the roots being particularly abundant and troublesome in a garden. Similarly, Raspberries throw up numerous stems; and these will be found to issue from the horizontally spreading roots. The new shoots arise from the internal layer of tissue of the root, called the "pericycle," and issue by dissolving the superincumbent cortical layers. Hence they are said to be "endogenous" in their growth, *i.e.* issuing "from within."

Subterranean Stems.—Various modifications of these exist for propagative purposes. If it be a more or less globular body, it is called a corm, as of Crocus, Gladiolus, Cyclamen, &c. The function is to store up a quantity of nutriment for the bud upon it, when it begins to grow into an aërial plant. If several thick internodes form a horizontal mass, it is called a rhizome; if vertical, a root-stock, as of a Primrose. If underground branches cease to elongate, their last formed internodes swell into tubers, as of the Potato.

If underground shoots can elongate freely they form creeping stems, as in Grasses and Sedges on sand-hills by the sea.

The question arises, why are some forms thick and fleshy, while others, as the last named, are long and slender?

There are good reasons for assuming such to have arisen through the character of the soil, whether it be "stiff" in the former case or loose in the latter. In this case they will run to great lengths of many feet.

In species of Mint, after the terminal bud has arisen above-ground in summer to make the annual aërial flowering-stem, it will send out numerous lateral *subterranean* shoots; but if one or more happen to be just above-ground they will take the form of aerial runners. This fact is very suggestive of the origin of runners in such plants, in which they now habitually occur, without subterranean creeping stems at all, as of Strawberries, *Ranunculus repens*, &c.

With regard to the origin of corms, tubers, &c., it is probable that these are due to their having originally grown in a heavy soil, for there is no reason to suggest a different cause for such stems from that which is known to produce "long" and "short" roots in Radishes, Carrots, Turnips, &c.*

Bulbs are usually subterranean buds, consisting of short, fleshy bases of leaves, inserted upon a conical axis, which may terminate with either a flower-bud or leaf-bud.

The bulb-scales are, of course, storehouses of nutriment for future use. How did they arise?

That a part of a petiole of a leaf should remain on the stem with its cells full of starch, while the rest of the leaf-stalk with the blade falls off, is not unknown. Such is the case with our Wood-sorrel (*Oxalis Acetosella*).

Now, if the bud in the axil of a leaf receive and store up the nutriment, its rudimentary leaves become thick scales. This is the case with other species of *Oxalis*. But in many of the Stone-crop family (*Crassulaceæ*) the buds are green and become "offsets" on stolons, capable of being detached and of growing into new plants.

In *Sedum dasyphyllum* a single leaf may be detached and carry away a minute bud at its base, and supply water and nutriment to the latter until it is independent, by having developed roots of its own.

In *Lilium bulbiferum* and some other plants the bulb-scales are more compact, only the surface remaining green, and as the stem decays they fall off and will then reproduce the Lily.

It is more common, however, to find bulbs on underground stems, generally proceeding from the axils of the parent bulb-scales, as in Lilies, Hyacinths, Garlic, &c. Sometimes they are borne by creeping stems, whether above or below ground, as on those of *Oxalis cernua*.

We see here a compensating process. In the long, creeping stems, or stolons, which send up tufts of leaves at each node, as on a Strawberry-runner, Sand-grasses and Sedges, &c., there is no need to store up more food than the stem can contain. As soon as roots are formed each node produces an independent plant In *Oxalis cernua* the creeping stem is very slender and perishes in the dry season: so as soon as the plant dies

* Pliny tells us that the Greeks discovered how to change the "female" or long-rooted Rape into the "male" or round form by sowing the seed in a cloggy soil. M. Carrière "ennobled" the wild Radish, and found long forms were mainly produced in a light soil, and more or less round roots in a stiff one. M. Languet de Sivry experienced similar results with Carrots. See *Origin of Plant Structures*, p. 186.

the nutriment at once goes to the bulbs, consisting of two or three fleshy leaves, with a minute bud between them.

I have mentioned that whatever property a plant may possess, or have acquired, it is not only in the possession of the special part of the plant where it is usually localised, but it is held in a potential way in every portion of protoplasm. Thus, though, judging from analogy, the tubers of a potato-plant were originally formed by the obstruction of the soil to the elongation of its underground branches; yet, if they be prevented from forming altogether underground, by their constant removal as soon as they appear, then the aërial branches will be arrested and assume the form of axillary tubers. Again, cuttings of potato-branches, instead of striking root, will often form tubers instead; and a potato left in a dark cellar sent out numerous colourless branches from the "eyes," and these, too, bore numerous small tubers all over them.

Propagative Leaves. Leaves can both normally and abnormally produce roots and buds, and so give rise to independent beings. Familiar examples are *Bryophyllum calycinum* and *Asplenium bulbiferum*; but several other Ferns are also liable to the production of propagative buds. The Water-cress and Lady's Smock do so occasionally, and several plants, as Gloxinias and Begonias, are habitually propagated artificially by means of the leaves alone. In the former, the buds are borne by the leaves in air; but in the latter case the leaves require the stimulus of a damp soil to produce them.

"The first change observed" (write Drs. Kerner and Oliver*) "in a leaf which has been cut off for the purpose of forming cuttings is the desiccation of the cells lying next to the cut surface. Beneath the layer of dried-up cells a cork-tissue is formed, whilst the dead, outer layer is converted into bark. A parenchymatous tissue is next formed from the part beneath the cut which is still living; indeed, it is the epidermal cells nearest to the dead layer of cells that initiate this formation of tissue. They grow in a radial direction, elongating and dividing by means of the insertion of transverse walls, the result being a uniform thickening coextensive with the surface of the wound. A little later some of the living cells in the middle of the cut, which are still covered over by the dead layer, begin to divide; and as the tissue there grows in size, it tears the overlying dried layer into shreds and pushes it off in parts. This exuberant tissue has received the name of 'callus.'

"In order to secure water from the soil, the leaf now develops absorbing cells resembling ordinary root-hairs. When the callus has acquired a sufficient growth, numerous roots are formed. They issue from the layer of cells adjacent to the vascular bundle of the leaf, probably homologous with the pericycle of the root; they break through the callus and penetrate the soil. Then buds begin to appear on the upper side of the leaf, issuing from the callus."

In all cases, whether normal or not, the appearance of leaf-buds shows that it is a property of plant-life which resides in the protoplasm of every living part of the plant.

Buds Replacing Flowers.—A compensatory process between the vege-

* *The Natural History of Plants*, ii. p. 42.

tative and reproductive systems of flowering and flowerless plants has often been observed.

If a Pear-tree makes too much wood and foliage, the fruit may be deficient, just as the Horse-radish increases its rhizomes and roots at the expense of fruit, which is never formed.

Many plants have actually become habituated to the practice of substituting leaf-buds for flower-buds. This occurs in plants usually called "viviparous," as Onions, and *Polygonum*, as well as Grasses and Sedges in the colder regions.

In the case of corms and bulbs being formed in the place of flower-buds, these are readily detached; but in viviparous Grasses the whole panicle falls to the ground, and the little buds then strike out at once.

Not only can such vegetative but reproductive bodies take the place of the entire flower, but they may be formed in lieu of ovules in an ovary. *Amaryllis* and *Crinum* are well-known genera which bear them. Thus M. Baillon writes* of *Calostemma Cunninghamii*, in which there is a transformation of an ovule into a bulb:—"The chalaza thickens, and plays the part of a 'plateau' upon which are produced several adventitious roots. The ovular coats replace bulb-scales; while there grows up from the embryo-sac a true bud, which escapes by the summit of the ovular cavity and so forms a perfect plant."

* *Bull. de la Soc. Bot. de Fr.* xxi. Rev. Bibl. p. 30.

THE AWAKENING OF BUDS AND THE SLEEPING OF LEAVES.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

Lecture to the Students at the Society's Gardens, June 18, 1901.

Introduction.—Buds are primarily the result of the lowering of temperature in autumn; for as soon as this rises above a certain degree they burst open and begin to grow. But the elements of a bud are not merely or entirely arrested structures, whether temporarily or not, as are the minute leaves within them; for the outer "bud-scales" are special formations protecting the more delicate parts within. Now these scales are not always the same thing, for Nature is never at a loss to make any structure, and if it be not convenient to construct it out of one thing she simply utilises another for the same purpose, as we shall see.

Bud-scales may protect the undeveloped leaves or flowers. I am here only concerned with the former. To find out what a leaf-bud consists of we must collect some examples, and I would suggest the following as illustrating the remarks I am about to make. Horse-chestnut, Ash, and Walnut, these have one kind of bud-scale; Elm, Lime, and Hazel will be good examples of a second kind; the common Laurel and Rose represent a third sort; while Lilac, Privet, and the Wayfaring-tree (*Viburnum Lantana*) will stand for a fourth.

Of course there are many other kinds of buds, as those borne underground by subterranean stems of various sorts, such as bulbils, corms, &c.; but space will not allow for any further reference to these. My object is to call attention to the peculiarities of buds of trees and shrubs, hoping it may lead others to observe some very curious phenomena connected with them for themselves.

Petiolar Bud-scales.—Selecting a lateral bud of the Horse-chestnut, it will be seen to have overlapping, dark brown, very sticky scales; removing these there will be found a little woolly body in the middle, and on "teazing" it out with needles it will be seen to consist of minute leaves densely clothed in white wool, an excellent protection against injury by low temperature, as wool is a non-conductor; so that if one be spread out flat it looks like a miniature woolly glove. Now, what are the leaf-scales? Let us imagine spring has come—and the bud must be examined when it does—we shall find that the outermost dark brown resinous scales are being thrown off (the sticky matter was secreted by their surfaces), having now done their duty of protecting the leaves within; but the innermost and greener scales become more elongated and show little stunted rudiments of blades at their tips. These reveal the fact that the bud-scales are "arrested leaves," but of which the petioles are abnormally flattened, the blades remaining very minute.

As soon as the true leaves can escape, the observer must notice how the leaflets at once curve downwards, so as to put their *upper surfaces* in a vertical plane, for this position lessens the chance of injury from

radiation of heat, and it is not until they are pretty nearly full-grown that they finally acquire a horizontal position.

Fig. 161 illustrates the former state of the leaves, and if this be compared with the accompanying figure of a Lupine when "asleep" at night (fig. 162), it will be seen that the position of the leaflets is the same, for the object is identical. The Lupine, moreover, is an adult leaf, and sleeps periodically, the leaflets falling at eve and rising at dawn.

The Walnut has a pinnate leaf like the Ash, with four or five pairs of leaflets. As soon as the leaf can escape from the bud the main petiole curves strongly downwards (fig. 163). The leaflets, as is usual with most plants, as Horse-chestnut, Rose, Laburnum (fig. 168), &c., are "conduplicate," *i.e.* the two halves of the blade are folded tightly together, like a sheet of note-paper. This protects the upper surfaces, while an additional advantage is gained by the blades being placed at first vertically. As the pairs of leaflets are developed they open out and become horizontal, one pair after another, until the whole leaf is mature.

In the Ash the dark brown buds consist of petiolar scales, and if examined in spring they afford an excellent illustration of transitions

FIG. 161.
Horse-chestnut.

FIG. 162.
Lupinus pilosus.
Leaf, seen laterally, asleep at night-time. After Darwin.

FIG. 163.
Walnut.

between petiolar scales and true leaves. Instead of curving downwards on expansion, as in the Walnut, the petioles are erect, but this still enables the undeveloped leaves to stand in a vertical plane.

In the winter, however, on dissecting a bud after removing the scales, a pellet of dark brown wool is seen, and on teazing this out, little white leaves will be found on which the wool grows. The hairs are filled with pale brown liquid and granules.

Stipular Scales.—Many of the plants are provided with a pair of small appendages at the base of the leaf. These are called "stipules," and the leaf is said to be "stipulate." Those hitherto described had none and are, therefore, "exstipulate." Now what are "stipules"? They represent a basal pair of leaflets in compound leaves, and detached basal portions of a single leaf; but instead of growing out of the petiole as leaflets, as, indeed, some stipules do, such as those of the Rose (though, the stipules having the new function of protecting the bud in the "axil," they do not assume the form of leaflets in the Rose), stipules usually arise directly from the stem, *the connection with the petiole of the leaf being concealed within the stem itself.* The rule is that three, five, or more "fibro-vascular cords" pass out of the cylinder of wood within the stem and enter the petiole of the leaf. Then, *secondary cords branch off from the two lateral*

petiolar cords and enter the stipules. If there be two opposite leaves, then two horizontal cords run round the stem from the one leaf to the other, forming a "stipular fibro-vascular zone." From this arise the cords which enter the stipules. This is well and easily seen in the Galiums, such as "Cleavers." If a thin section be made by cutting the stem just above and below a node and be held up to the light, the true leaves will be detected by having their cords issuing from the stem-cylinder; but all the other "leaves," really stipules, are provided for by the "zone" alone.

The Lime is a very interesting case. The small brown buds consist of stipular scales with rudimentary conduplicate leaves within them. This should be carefully studied in the spring, and I will here quote what I have elsewhere said about it.* As soon as the bud expands, while the inner stipules develop considerably, those on the upper side are concave and ovoid and cover the upturned edges of the conduplicate leaves, which at once take a position in a vertical plane; the stipules at the sides elongate much more than the former, furnishing some lateral protection to the whole bud, which now curves strongly downwards and somewhat

FIG. 164.

FIG. 165.

FIG. 166.

The leaf-bud of the Lime in different stages of development.

resembles a mussel in shape (fig. 164). As the bud continues to develop, the branch becomes more and more strongly curved downwards, so that the leaves are held vertically (figs. 165 and 166), and as the lower and older ones increase in size they assume a horizontal position and undertake to protect the younger ones, which are concealed beneath them. Thus the protecting care is handed on to each leaf as it arrives at maturity, until the whole series is developed and the branch and leaves become horizontal.†

Petiolar-Stipular Scales.—In the case of the Rose the stipules are "adnate," or growing out of the petioles of the fully developed leaves, appearing like wings on the sides. Being at first placed face to face, they protect the young bud nestling between them; but as winter bud-scales they are very minute, possessing three points at the apex, which reveal their true nature, for the middle point indicates a totally arrested blade. On dissecting a bud the minute pinnate leaf with conduplicate leaflets can be detected within. As in the case of the Walnut, so does the Rose

* "On Vernation and the Methods of Development of Foliage as Protective against Radiation."—*Journ. Lin. Soc.* vol. xxi. p. 624.

† See some beautiful illustrations of the Lime, Beech, Elm, &c. by Lord Avebury (Sir John Lubbock), in his paper on "Buds and Stipules."—*Journ. Lin. Soc.* xxxiii., parts 12–15.

curve its half-formed leaf downwards, the several leaflets all being at first packed together side by side, till the time comes to expand them and to assume the horizontal position.

Fig. 167 represents a young shoot of the Portugal Laurel. The stipules are still present, but will soon fall off. The whole branch has grown erect, as in the Ash; while the blades are seen to be conduplicate, the two halves are, however, represented as just beginning to separate from each other.

Laminar Scales.—For a bud-scale to be constructed out of a metamorphosed blade of a leaf is comparatively rare compared with the previous methods; but such occurs in the Lilac, Wayfaring-tree, and Conifers, in which the common needle-like leaf is reduced to a subtriangular form in the outer scales.

On dissecting a lilac-bud the scales increase in size from without inwards, being elongated and boat-shaped, with a distinct midrib and

FIG. 167.
Portugal Laurel.

FIG. 168.
Laburnum.

branching lateral veins, as in a true blade, until one is arrived at having a short, distinct petiole and a "cordate" base, when the true blade is clearly revealed. This bud shows how rash it would be to assume that the outer scales were of the same nature as those of the Ash or Lime, though they are all apparently precisely alike externally.

*Vernation.**—This word is applied by botanists to signify the various ways in which the young leaves are packed up in the bud: on the one hand, how each individual leaf is folded; and on the other, how it lies with reference to the rest. The commonest method in the first case is, as stated, to be conduplicate; and in this kind they may be flat, as in the Lime, or crumpled, like a closed fan, as in the Currant and Beech.

With regard to the ways in which the leaves cover one another, a common method is to have the halves of a blade slightly separated, and so, standing at an angle, they can then fit over the others, either in two ranks, as in Grasses, or three ranks, as in Sedges. A third common method is to have each scale and leaf rolled round all the interior ones in succession, as in the Cherry.

The various differences can be best studied just as the bud begins to

* From Latin *ver*, "spring"; vernation may therefore signify "spring quarters."

expand and its parts to grow, but before they have escaped, and while the relative positions are still maintained.

We have seen that the object in having the young leaves conduplicate, and in placing them in a vertical plane, is to reduce the injurious effects of the loss of heat by radiation to a minimum; so that the upper surfaces especially should not be chilled, and thereby injured or even killed.

There are many plants of which the foliage is said to sleep at nights; and the object is precisely the same. The phenomenon is particularly common in the Pea family (*Leguminosæ*); and it is interesting to see how different plants having similarly formed leaves yet sleep in very different ways. As good examples to illustrate this let us take the Clover, Medick, Melilot, and Wood-sorrel, as all of these have "trifoliate" leaves—*i.e.* the compound leaf consists of three leaflets on one main petiole. It is worth while contrasting the form of the young leaf with that of the adult leaf when asleep. The Clover leaf and that of Wood-sorrel are, when undeveloped, precisely alike. The petiole is curved so as to place the blades in a vertical position, while all the three leaflets are tightly pressed together with conduplicate blades, so that a cross section shows six edges placed side by side.

When, however, a full-grown Clover leaf goes to sleep from having had the three leaflets spread out horizontally by day; first, the two lower leaflets rotate through 90°, so as to stand vertically; then they move horizontally till they meet in front, with their upper surfaces in contact. Finally, the terminal leaflet rises up, passes through a semicircle, or 180°, and comes down like a sloping roof over the upturned edges of the other leaflets. Thus it remains till the following morning.

Comparing this with the Wood-sorrel, though its leaflets were compacted exactly in the same way as those of the Clover when very young, yet when they sleep they simply drop vertically and slightly bend along the midrib, so that the three leaflets can fit in closely, their midribs lying along the petiole.

Medicago has also a "trifoliate" leaf, and behaves precisely like a Clover leaf, but the Melilot does not. The lower leaflets move as in the Clover, but the terminal leaflet behaves differently. It places itself parallel to the other two in a vertical plane, and then moves to one side and places its upper surface in contact with that of the leaflet which it approaches. We thus find at least three different methods among four plants.

Lupines are interesting as also furnishing three methods in as many species. Thus *Lupinus pilosus* drops its leaflets when asleep, as shown in fig. 162; but *L. Hartwegii* raises them like an inverted shuttlecock; while *L. pubescens* differs from both, in that while the shorter leaflets fall the larger ones rise; the result being that the whole of the leaflets are in a vertical plane. The leaf has thus changed from being, so to say, a horizontal star to a vertical one.

HOW PLANTS CLIMB.

By Rev. Prof. G. Henslow, M.A., V.M.H.

Lecture to the Students at the Society's Gardens, June 26, 1901.

The questions naturally arise, why do some plants climb? and how have they acquired their climbing properties? A possible origin or cause may be suggested by *overcrowding*; when certain weaker plants, utilising the common property of circumnutation, and acquiring a greater degree of sensitiveness, became stem-twiners, leaf-climbers &c. Circumnutation and sensitiveness are universal properties in plants, in varying degrees; thus, they both may be seen in germinating roots. The former is exhibited by germinating stems which bend to all points of the compass as they elongate. It is well seen in the terminal shoot of a Fir-tree, which, if observed from time to time, will be noticed to have changed its direction, until it finally straightens itself below and remains erect, the apex, however, still continuing to nutate. This shows that there is a certain antagonism between "lignification," or the consolidation of tissues, and circumnutation; so that as soon as a stem becomes rigid by strengthening itself, circumnutation tends to cease. Consequently, if stems be weak when overcrowded, they might continue to circumnutate when growing to greater lengths; and perhaps such conditions might be favourable for an increased sensitiveness, but of this we know nothing.

Climbing "Lianes" in tropical forests often take the forms of ropes and bands which completely invest the trees in an inextricable network, and a feature which has long been observed is the anomalous nature of the woody stems of such climbers. They belong to several families of plants, and, generally speaking, their peculiarities are characteristic of their families respectively. Thus, in the *Malpighiaceæ* the tendency is to make the wood deeply lobed by excessive growth at certain points on the circumference, instead of uniformly all round. Then, as the twining stem becomes twisted, a result of continued growth after the stem has become linked to another, it now exactly resembles, and indeed acquires the strength and flexibility of a stout cable of many strands. It is difficult not to entertain the suspicion that Nature has been following the same method as man, in making a strong rope out of what would be, when isolated, a number of weak materials. As the Lianes are necessarily subjected to all sorts of strains, the cable-like form is admirably suited for their requirements.

The genus *Bauhinia* of the *Leguminosæ*, and its allies, are like broad ribbons, as the stem increases only on the ends of a single diameter; but besides this flattening out, the ribbon bulges alternately first on one side, then on the other, thus affording great additional strength; while in some cases, like the so-called "Monkey's Ladder" (*Caulotretus*), wing-like appendages are added to the sides. In others, though the stem may be round, on a cross section being made, the wood is found to take the

form of a cross, with large medullary rays of softer tissue intersecting it. However anomalous the wood may be, certain common features prevail, in that there is always a feeble lignification of the wood-fibres, with which are associated very many and large vessels, or long tubes. The usefulness of these two features is, in the former, excessive flexibility, and in the latter an easy means for water to be conveyed with great rapidity to the enormous lengths over which it must necessarily run to reach the foliage.

English climbers are mostly herbaceous, *Clematis Vitalba*, or the Traveller's Joy, and Honeysuckle, almost alone possessing anything of the nature of a woody stem; but these, as also a six-year-old stem of the Bittersweet (*Solanum Dulcamara*), exhibit just the same features in being excessively flexible and provided with many vessels.

Climbing plants may be grouped as follows:—

1. Those which climb by means of their stems; twiners, as they are called.

2. By branches.

3. By leaves; of these they may climb (1) by petioles, (2) by leaf-apices, (3) by midribs modified as tendrils.

4. By floral axes, as peduncles and pedicels.

5. By means of hooks; such may be (1) abortive branches, (2) leaflets, (3) peduncles, (4) cortical and epidermal prickles.

6. Lastly, there are aërial root-climbers.

As a great variety of these are described by Mr. Darwin in his work on *Climbing Plants*, it is unnecessary to give details here; but what one wishes to suggest, if possible, is the *cause* of the production of these different structures.

The old idea was that they, as indeed all adaptive structures in both the animal and vegetable kingdoms, were "designed," *i.e.* in anticipation of their use. This view cannot now be entertained, and we must look to the reverse process for their origins. That is to say, instead of a climbing organ being made *before* the plant climbed, we now regard it as a *result*, if not of having actually climbed, at least of having come in contact with some foreign body. To show the tenability of this view, we have first to observe the extreme sensitiveness to contact which exists in plants. Thus, a loop of thread weighing a quarter of a grain is sufficient to cause the petiole of *Clematis montana* to bend; and when an organ has caught a foreign body and remains in contact with it, this sensitiveness compels it to develop extra tissue to an extraordinary degree. Thus, the petiole of *Solanum jasminoides* has three fibro-vascular cords on the lower side; but, after clasping, the wood forms a complete zone as in an ordinary stem. Similarly, hooks, if they catch anything, thicken and enlarge out of all proportion to the size attained by non-clasping individuals. Thus one arrives at the conclusion that sensitiveness causes a climbing organ first to twist round its support, and secondly to thicken. From these facts one deduces the origin of the *form* of the organ, say the tendrils of the Pea. It consists of the midribs only, which are now highly sensitive. As a leaflet acquires this property, so in compensation the power to make the flat blade ceases. An intermediate condition is seen in *Corydalis claviculata*, described and figured by Mr. Darwin, in which the leaflets

exist in all stages of passage, from a full-sized and non-sensitive blade to nothing but a highly sensitive midrib.

The course of development, then, seems to be as follows:—First, by circumnutation contact is maintained, then supersensitiveness is excited; adaptive growth and development, with alteration of structure, follow, and the climbing organ is finally produced in the course of generations. When once formed, the organ, with its properties, becomes an hereditary feature.

Good illustrations of this last result are the two commonly grown species of *Ampelopsis*. *A. hederacea*, the Virginia Creeper, has a tendril constructed out of a flowering branch. It makes the feeblest attempts to climb round any foreign support; but as soon as the little hook-like extremities of the branchlets of the tendril can catch any roughnesses in a wall, the effect of contact is soon seen. Not only do they swell into little pads, but secrete an adhesive substance; while the branchlets curl up like irregularly formed corkscrews, and thicken greatly. That all this is the actual result of contact is seen by the fact that if any tendrils fail to secure a hold they soon fall off.

In *A. Veitchii*, the Japanese species, the tendrils have their pads already partially developed in an immature condition, before any contact is made at all; so that the one species throws light upon the other, in that not only is the power to produce the pads hereditary (as in *A. hederacea*), but the actual result has become anticipatory in the latter species, just as an eye is formed before it can feel the effect of light.

The climbing property, having become inherent in the constitution and hereditary, may be held in abeyance, but be still potentially there. Thus, dwarf French Beans make strong stems and have no need to climb; nevertheless, they occasionally throw out a long shoot which twines round any support. Certain species of *Ipomœa*, allied to *Convolvulus*, of South Africa, never climb in the wild state, but when transferred to Dublin took to climbing at once. Perhaps the most remarkable is a tree called *Hiptage*. This is grown in gardens in Cairo. It has a fair-sized trunk, with thick branches. Suddenly a long whip-like shoot appears and twines up anything it can come across. As it belongs to the order *Malpighiaceæ*, which has several climbing Lianes, it is a tree whose ancestors evidently were accustomed to climb, and has retained the power though it is quite useless, for the tree is perfectly well able to support itself.

INJURIES TO PLANTS BY LONDON FOG, AND BY ENGINE SMOKE.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

Lecture to the Students at the Society's Gardens, July 4, 1901.

Injuries to plants in the suburbs of London may result from both London fogs and railway engines. The former prevail with anticyclonic conditions of the atmosphere, when the barometer is high and a north-east or east wind prevails. Hence the effect of the fog is seen in the west and south-westerly directions. The air being comparatively heavy, the fogs are felt near the surface of the earth. With these "dry" fogs, as they are called, it is found that the water-particles are invested with a carbonaceous and, as it proves, a poisonous substance.

Much injury has been done to gardens in the open, and plants under glass, by the smoke of stationary engines when "blowing off steam," as it is called.

In both cases the general effect, allowing for various degrees of injury, is the same, and these are of two classes: viz., first, injury resulting from the arrest of light; and secondly, from the poisonous nature of the ingredients of smoke.

I will first consider the effects of the partial arrest of light, due to the adhesive nature of the carbonaceous materials, which cling tenaciously to the surface of the glass. Indeed, it cannot be at all easily washed off, but has to be actually scraped with a knife, to be satisfactorily removed.

On looking at the sun through a London fog, if it be visible at all, it will be seen to be of an orange-red colour. This means that the more refrangible half of the solar spectrum is absorbed to a greater extent than the less refrangible or "red end."

Similarly, in testing a piece of glass from a greenhouse, thickly coated with sooty matter from a railway engine, the blue rays proved to be more strongly absorbed than the red ones.

In both cases there is a great deficiency of light.

Experiments have proved that when plants are grown under glasses which transmit red, yellow, green, blue, and violet, as the *predominant* rays—*i.e.* they appear to the eye to be only the colours named—then the first obvious effect is the elongation of the stems under red, yellow, and green, with a short stem under blue and violet. Such, at least, was obviously the case in the writer's experience with Lettuces, &c.

The next effect is the relative degrees of impoverishment. The process of assimilation gave two maxima, one under yellow and another under blue glass, while in all cases under glass the deficiency was very marked, *i.e.* as compared with plants grown normally in the open air.

Analogous results occurred in glasshouses, on the roof of which engine

smoke had deposited a coating of a dark grey colour. Thus Fern-fronds had abnormally elongated stalks, and the stems of Pelargoniums were "drawn" to an inordinate degree.

Not only is it Assimilation which is affected, but Respiration, which does not depend upon light, as it goes on at all times, is enfeebled. For this purpose, as with our own breathing, oxygen must be absorbed. This, however, is impeded, owing to the faulty circulation of air within the tissues; the substances which ought to undergo further changes remain incompletely oxidised. This causes an accumulation of organic acids within, and a "yellow spottiness" is visible without.

The next ill effect of the check to light was the hindrance to Transpiration. Experiments show that the rays which particularly favour this function are red and violet. Now the violet rays are just those which appear to be especially reduced. Consequently, it is not surprising that the foliage became succulent and the stems of Pelargoniums soft, instead of being firm and woody. To stow away the water which the plants were incapable of transpiring the leaves grew coarse and large. But there is nothing to prevent the plants from absorbing moisture from the soil by their roots. Consequently, as the loss of the excess by the normal process of transpiration was hindered, the water accumulated within the plant. This accounted for the increased succulency of the tissues. The vegetative energy was thus called upon to do abnormal work, so that the flowering process suffered; not only was there a probable loss of the extreme refrangible rays, which Sachs thought peculiarly favourable to the flowering process, but a decided check was incurred from the excess of vegetative vigour, so that the trusses of Pelargoniums were poor, and often consisted of two or three flowers only. There was the additional effect of starch being very imperfectly formed, as the special rays required for assimilation were more or less arrested; and since flowers cannot be formed unless reserve food materials are present, or else there be healthy foliage to make them, it was not surprising to find great deficiency of blossom.

It must be borne in mind that although certain rays may favour one process, and certain others another process of plant-life, plants require *all* the rays of the sun, and they suffer at once if *any* are more or less arrested. The *worst* colour is *green*. This is not only proved experimentally, but might be inferred from the fact that whether a leaf be translucent or the light be reflected from the surface it is green light which is thrown off and reaches the eye, showing that this coloured light has not been absorbed, and therefore not utilised. As green glass means that all the rays *except* green are more or less stopped and absorbed by the glass, therefore just those rays only which are useless to plant-life are allowed to pass through. When Decimus Burton built the Palm-stove at Kew, Professor Daubeny suggested a glass tinted with green to check the glare. Luckily the "tint" is so slight as to do no harm; but it has been found necessary to remove the green glass from the Fern-houses.

The next ill effect to be considered is the result of the tarry matters which not only affect trees and herbs in the open, but plants within the houses. Prof. F. W. Oliver has given so elaborate an account of his experimental researches that the reader is referred for details to his

paper.* He gives two analyses of London fogs, one from Chelsea, the other from Kew. Supposing a country fog (formed by condensation of moisture in the air, far away from any smoke) to consist pretty nearly of 100 per cent. of water, we find that a fog at Chelsea had 39 and at Kew 42·5 per cent. of carbon. Then, while the fog at Chelsea had over 14 per cent. of hydrocarbon, &c., Kew had nearly 5 per cent., showing that there is by no means any uniformity in the contents of fogs. Sulphuric acid occurred in both to about 4 per cent. Mineral matters amounted to from 34 to nearly 42 per cent. Lastly, water was only 6 per cent. It is no misuse of terms, therefore, to call them "dry" fogs!

We have considered the effects of carbon and hydrocarbons as making a tenacious grey coating upon glass, but the injury upon the plants by direct contact is much greater.

Although the analyses mention sulphuric and not sulphurous acid, the former is only derived from the latter by oxidisation; and both acids are highly injurious. Prof. Oliver found that the amount of sulphuric acid in London air varied considerably, in his laboratory at University College, Gower Street. Thus the average amount in dull weather was 6 milligrammes per 100 cubic feet of air. The amount in a slight fog was 8·16; while in a thick yellow fog it amounted to 20·4. Sir William Dyer points out that sulphuric acid (H_2OSO_3) when formed becomes permanent and cumulative; when diluted, it has no immediate effect on wood; but if it be heated so that water is driven off, then the SO_3 at once burns into the wood. Hence he says: "H_2OSO_3 acts as a persistent and gradual caustic. The same acts again and again and eats into the tissues."

On the other hand, sulphurous acid is mostly injurious to herbaceous and soft-wooded plants. It penetrates the houses, and the water on the glass sides, produced by evaporation, becomes charged with it, so that any leaves which happen to press against the wet glass turn brown and the portion dies. Or, again, as the water drips from the tips of leaves, the tips turn brown and shrivel. As another effect, the water will not readily evaporate; vaporised tarry matters probably helping to cause this: the result is that Fern-fronds hang down, get pressed together and rot.

The way sulphurous acid acts on the plant is by abstracting oxygen from the living protoplasm (being a powerful deoxidiser) in becoming sulphuric acid. It thus, of course, kills the protoplasm and destroys the necessary turgescence of cells for active growth. The consequence is that leaves and flowers die and fall off.

The general effect of the sulphurous acid, as well as the vaporised and toxic-hydrocarbonaceous matters, is local discoloration of the leaves, and if the rest be still green they remain on. The local blotching is actually due to sulphuric acid; for on watering the plants the water takes up the sulphurous acid, and then by oxidisation the sulphurous is changed into sulphuric acid, which kills the protoplasm. On examining such leaves microscopically Prof. Oliver observes that it is found that the upper epidermis is first attacked. The acid traverses the cuticle and destroys the underlying cells. Destruction of the protoplasm follows.

* *Journ. Royal Hort. Soc.* vol. xvi. p. 1, 1893.

This turns brown, and the action then passes on to the subjacent tissues until it has worked its way through the leaf.

It often happens that disarticulation takes place with great rapidity, even while the leaves are green. The fog enters the lacunæ of the leaf through the stomata. In other cases varying degrees of yellowing or browning precede disarticulation.

When this is the case it closely resembles autumnal fall of the leaf, in that all useful materials, as starch, oil, &c., are removed before the leaf falls. This, too, is brought about by the usual "absciss" layers, but formed abnormally and very rapidly. It is thought that some ferment may be produced which may assist in the process by dissolving the tissues, so as to account for the rapid fall.

The disarticulation can take place in forty-eight hours after the commencement of the fog. In the Palm-house many bushels of green leaves were gathered up almost every morning during a persistence of London fog.

Speaking generally, the flowers and flower-buds are the first to suffer. The injury may, in fact, be confined to these at distant localities. Thus, near Richmond, a Camellia lost 100 buds in one night, but was not otherwise injured. If the flowers be half expanded, discoloration and desiccation occur, as this is the most critical period. If they be fully expanded, flowers will sometimes escape injury. Prof. Oliver remarks of *Rhododendron jasminiflorum* that the flowers were uninjured as long as the inflorescence remained wrapped in bud-scales. But when the buds attempted to open during the prevalence of a fog they were caught. The buds pushed the scales aside, but rarely succeeded in freeing themselves from them.

With regard to the effects of London fog at Kew, it is said that Ferns scarcely suffer at all. This is remarkable, because in the case mentioned above, where Ferns were largely grown for market, they became unsaleable in consequence of the effects of the smoke from adjacent railway engines.

Lastly, the Curator of the Botanic Gardens, Regent's Park, has made the following observations upon the injury sustained there :—

"The Botanic Gardens afford a good example of the increasing damage due to this cause. As is well known, many plants, such as the Conifers, will not live in the open air within the Metropolis ; even in the greenhouses it is the same ;—the purer air is counterbalanced by the loss of light arising from soot-covered glass. The Kitchen Garden of the Gardening School stands upon what, thirty years ago, was a Rose Garden where most of the principal varieties of this lovely flower flourished in company with great clumps of white Lilies, Phloxes, Carnations, and drooping masses of purple Clematis. At that time it was one of the most beautiful features of the Gardens, but as the growth of London became more rapid, and the air more deteriorated, first one plant sickened, and then another, until only the name was left, and the ground had to be turned to other uses. A few of the old roots which showed any signs of life were removed to the purer atmosphere of Ealing and recovered ; these when last seen were flowering well, and doubtless are doing so now, since there is hardly any limit to the life of a Rose."

ON THE CULTIVATION OF ONCOCYCLUS IRISES.

By the late Rev. H. EWBANK, M.A., F.R.H.S.

[*A very melancholy interest attaches to this paper. It was written during Mr. Ewbank's last illness, and was corrected for the press as he lay upon his deathbed, and less than a week before he died. He was a true and ardent lover of flowers and of all plant life, always seeking to know them and their ways better and still better—ever learning even to the end—and always willing to communicate his knowledge, but so humble that he thought he had little to bestow, whereas in reality his mind was wonderfully furnished with unfailing stores of knowledge drawn from the deep wells of personal experience and constant observation. He will be a great, almost irreparable loss to amateur gardeners here. He surely will be welcomed in those other gardens where neither plants nor those that tend them experience disease or ill.* - ED.]

THE Secretary will bear me witness, I know, that I have never had any thought of instructing the members of the Royal Horticultural Society on this rather difficult subject, and if he had not urged me to retail my experience I should never have done it. I confess to being excessively interested in it, and I have been so for a long time; and it does happen that there is one point about which, according to my present ideas, some very considerable light has been vouchsafed to me of late, and this I am ready to lay before the Society now; or, to put the same thing in a rather different way, I will explain the point at which several of us have arrived. My readers must kindly understand that Sir Michael Foster and Herr Max Leichtlin have been my special instructors, and I do not think I have deviated in principle from what the former laid down in his article in the *Garden*, November 28, 1891, and also in visits which I have paid to him, or from what fell from the lips of the latter on different occasions at Baden-Baden. My own article in the *Garden*, September 1, 1894, was little more, and it certainly never laid claim to being anything more, than the application of their theories to my own practice in the Isle of Wight. And now for results. They have been of a very varied description. I do not think that I have ever been without a fair number of blossoms; it has been sometimes more and sometimes less; in some years I have been greatly delighted with success and I imagined that the whole thing had been done, and then my expectations were dashed and I have not met with the improvements I desired. It is, however, only right to say that my garden is a sort of horticultural trial ground, and I should occasionally have done better than was the case if I had been content to let well alone; but I have constantly gone in for improvement, and improvement has not always come off. One year I severely injured my whole collection and I lost a great many Irises through an experiment for which I thought there was justification, but the event showed plainly enough it was not so. Results, therefore, have often been of a rather mixed description.

There has been *quite enough* of good about them to make me feel sure I was on the right track—I have frequently had some very splendid blossoms—and yet enough of uncertainty and imperfection remained to make me long for a more decided advance. This decided advance has come at last, I think, and it is that which I venture to describe to you now. I can only tell you how things are with me on this head up to date. It is a very odd thing, as I dare say you have noticed, how, with discoveries of a magnifical and universal importance and also with those of a trivial and very insignificant value, precisely the same thing seems to strike different persons at the self-same time. There is no claim, of course, made for the subject of these remarks that it belongs to the first of these two classes. But small and trivial as it is, it illustrates a sort of general law so far as it can do it. Not a few of those who were anxious to know what these Oncocyclus Irises most desire to have given to them altered their opinions at about the same time. It was very odd indeed that we all seemed to come last autumn to think that lime in some shape must be given to them so as to do well, whereas no one, so far as I know anything about the business, had ever *emphasised* or said very much about it before. This is the singularity of the whole affair. Whatever Herr Max Leichtlin says to me about any horticultural matter, I accept it without asking any question at all. Now, I perfectly remember his saying to me at an early date when the mode of cultivation for these Irises was discussed: "I do not think that the question of soil has anything to do with success in this matter. It depends on other considerations altogether." So after this piece of instruction I gave myself up to find out what "the other conditions" demanded, and I fondly imagined that good loam and perhaps some road grit would supply everything that was required in the way of soil. I thought I might leave soil alone and that it had been sufficiently considered. It was also noticeable in Sir Michael Foster's instructions in the *Garden*, November 28, 1891, to which I have referred above, how very little he says on this head. He only incidentally notices the fact that he lives upon chalk, and his words run thus: "On my own bleak chalk hill, where, in seasons other than the present one, the soil, specially the subsoil," &c., but he does not at all emphasise what follows from it, viz. that a good deal may be owing to this, and a little lower down in his communication he even raises a doubt as to whether there is any chemical efficacy about chalk with regard to these Irises, for he says about a place which is near his own, and where *Iris susiana* does well: "Yet there must be something in the place in question, something in the conditions, something *perhaps in the soil, and if so something probably in the physical rather than in the chemical nature of the soil which* determines success," &c. But this is the very point on which I should now respectfully join issue with him. I venture to submit, though this is rather antedating what has to follow, that the great reasons why Oncocyclus Irises like Sir M. Foster so much are, first of all, because they naturally take to one who knows so much about them—but secondly, and principally, because they *do affect* the chemical nature of the soil with which they are certainly provided in his place, and not, as he in this passage suggests, because of its physical properties, which are of less account with them. It is chalk or lime in some shape

or other which I believe is, with many of them, a kind of necessity for their well-being—a downright food—and the whole purport of this paper is to make it evident that such is the case. But, as showing how far some good horticulturists have gone on the wrong tack about this, I may be allowed to mention that Mr. Amos Perry, who is one of our best nurserymen, said to me that he considered it good practice if "four or

FIG. 169.—IRIS KOROLKOWI. (*The Garden.*)

five inches of soil are taken off the bed where Oncocyclus Irises are grown and they have a heavy dressing of manure to that amount." This I should now esteem to be quite out of the question, but Mr. Amos Perry is by no means singular in the opinions he held. I have been over the fine gardens of Messrs. Herb and Wulle at Naples, and we discoursed about Irises for a long time, but I never heard a word from them about

the advisability of having a chalky soil, nor do I remember anything pointing to it. With M. Dammann, of Naples, it was rather different; he also grows Oncocyclus Irises near the slopes of Vesuvius, and he did tell me that *Iris Gatesii, Iris Lorteti, Iris susiana*, and *Iris iberica* have a mild inclination for some chalky soil, but he mixed it up with so many other things—*e.g.* sandy loam, black-red loam, mould, old manured cucumber soil—that its value was obscured and I had very confused instructions to go upon, and I found it rather hard to comply with them, and so gave them up; but it is true that he did say something about chalky soil *inter alia*. Mr. F. Moore, the well-known director of the Royal Gardens at Glasnevin, has written to me that "he always used lime rubbish from old walls in making up the beds for Oncocyclus Irises, and then he gave them weak manure water in April to counteract the poorness of the soil."

Mr. F. Burbidge, whose experience in these things is so great, has written to me: "That is a most valuable observation of yours, *i.e.* lime or chalk for the Cushion Irises. May not this account for the unique success of Sir Michael Foster, F.R.S., who, as you well know, grows these flowers on the breezy crest of a chalk hill up among singing larks in the flinty barley-fields at Great Shelford?" This would tend to show that Mr. Burbidge had not before this year come to any definite conclusion about the advisability, or rather the *necessity*, of lime being used, and so also with several others. I am far from saying that lime has not been used at all in the cultivation of these splendid flowers. Mr. F. Moore, for instance, tells us that he used lime rubbish from old walls in making up his beds, but no great stress has ever been laid upon it, so far as I know anything about the matter. Many have gone on, year after year, "pegging away" at this point and that, but they have all the while completely overlooked the most important factor in the way of commanding success which can be anyhow named. It has not held the right place, in our estimation, at all, and has often been obscured and sometimes quite forgotten in the practice we follow. I would assert with all the strength and emphasis I can command that Oncocyclus Irises not only put up with, and are benefited by, the presence of lime in the soil, but that it is imperatively required by them in some shape, and they must have it if they are to do really well and also continuously. From what I have seen in my own garden, and the difference between this year and all the other years that have gone before it, I have come to think that lime is the missing link, so to say—the *sine qua non*—the imperatively needed factor in the cultivation of these beautiful flowers, and it should not be spoken of as a thing which may or may not be supplied, but as a prime necessity without which success can be only very comparative, but with which (other things being right) good results will ensue; and I feel so certain that this is very often left out of sight and not at all understood that I venture to add words to words so as to bring it quite clearly to the front. Now it is a fact that light came to me and to others simultaneously last year, and, as we think, in rather odd ways. We put two and two together, and there was only one conclusion to be derived from it all, which is, that most of these Oncocyclus Irises, if not all, are essentially lime-loving plants; they may, perhaps, get on without it for a time, but they will get on much better with it, and all who want to succeed with

them should bear this consideration in mind. Our discovery came about in this wise:—My friend here, Mr. Blair Cochrane, of Oakleigh, St. John's Park, is fond of his garden. and he took it into his head that he would grow Oncocyclus Irises; he accordingly bought a good lot of them, and he proceeded to plant them forthwith. It so happened that an addition was being made to his house, and without more ado he used a great deal of the rubble or old mortar which was lying about the place and he put his Irises in it; he also used the other measures which seemed to be necessary to success. The winter before last was not an especially easy one, but the plants, so to say, sailed through it, and he had a great deal of blossom the next spring with very little trouble about it. This was his first attempt, and he was led to suppose that the difficulty of growing Oncocyclus Irises had been very much exaggerated. Also I was told a short time ago, and it was a very curious circumstance which I believe to be quite correct, that Mr. Potter, the foreman of Messrs. Backhouse, at York, has to do with two gardens—one in Oxfordshire and the other in York. In the former of these two gardens (at Witney, I think) *Iris iberica* grows like a weed, in the other it will not grow at all; and he can only account for it by saying that in the one place it meets with plenty of lime, in the other it has none at all. And when my suspicions had been awakened by one thing and another, and I was musing over the matter, I received a letter from abroad in which the following words occur:—"From what I can see of my Oncocyclus Irises this year and the past season, I get more and more convinced that the want of lime in our soils is one of the chief sources of failure," &c. It all seemed to be tending the same way, and tallied exactly with the ideas that were then in my mind. I do not know that the story about Mr. Potter would have been sufficient to move me alone: there might be some explanation which would deprive it of all value at once; and Mr. Blair Cochrane's experience might only be accidental after all; but it was impossible to miss the conclusion that several things which were converging to the same point could only be explained in the same way, and it was likely that there was something here which ought to be followed up. At any rate I could not get it out of my mind that it was not well to take too much for granted, and it seemed as though the question of soil had a great deal more to do with the cultivation of Oncocyclus Irises than anyone had been willing to suppose, and of course when this stage had been reached all the rest followed upon it. I determined to put it all to the test and to be guided for the future entirely by the results which might be arrived at; and just then M. Van Tubergen, junior, through his representative, M. Hoog, proposed to me that we should make a series of experiments, of which the real purport was no more and no less than that of finding out if these particular plants are influenced or not by the soil in which they are planted. It was precisely the very thing which I desired to know myself, and I agreed with him at once that I would act by them in two or three different ways and would note the results that might be forthcoming. I leave M. Hoog to tell his own story to you here, which is of the greatest possible value. He has, on behalf of M. Van Tubergen, spared no trouble and no expense in the work, and it is very satisfactory to feel that he is well pleased with the conclusion to which he has come, and we both think

very much alike about it. Indeed, there is no gainsaying the fact that analysis with him has shown that there is a large percentage of lime in the soil where these plants grow naturally, and very little indeed in Holland and other places where so many failures occur. M. Van Tubergen's way of treating the Irises to lime has been very different from mine, but that is of inferior import; he joins hands with me altogether in the idea that lime must in some way be administered to them if they are to do well, and it may take a little time, perhaps, before it is absolutely discovered which method is the best. As I understood M. Hoog to say when he paid a visit to me in the spring, he was not quite sure if magnesia should also be employed or not. He had used it, as it was disclosed by the analysis he had made; but, turning to my Irises, he said, "If I were in your place I should leave it alone, as they seem to do so well without it." I, therefore, have not troubled myself about magnesia or anything else, except that I have treated these Irises as lime-loving plants, and I believe that this one consideration will cover everything else so far as the ingredients of soil are concerned. I mean that good ordinary loam will do for them with a little sand if it be thoroughly impregnated with lime. My practice was as follows:—It seemed to me that bone-meal would be as good a food as any which I could get for my plants, and if they like lime at all they would respond to its use. I accordingly sent for a large sackful of it to Messrs. Clay of Stratford, near London, and I distributed 112 lbs. of bone-meal between four large frames, giving to each one 28 lbs. or thereabouts. These frames, I should say, are 12 feet long, 3 or 3½ feet wide, and have a depth of 1 foot and a half or 2 feet above a foot or more of drainage, over which inverted sods have been put. The bone-meal was thoroughly mixed and incorporated with the loam which was put into the frames, and the Irises were planted in September last towards the end of the month, and now what is the condition of some three or four hundred Irises in the middle of March? So far as I know, they have got through the winter with the loss of only one or at most two plants. It is quite true to say that I have not noticed more than two "miffy" plants, and instead of first one and then another "going home," according to gardeners' slang, in very mysterious ways, I have had no losses worth speaking of at all. This is an immense alteration, and an alteration for the better, from anything I have ever known before, and this is not the whole of the case. The plants look now, in the middle of March, in the rudest health, and are doing exceptionally well; the colour of the foliage is very good, and the outlook is as favourable as it could possibly be at this season of the year. *Iris susiana* is quite tall already, and, unless appearances are wrong, it will soon be in blossom. It is quite true that I have only made this experiment once; there may be drawbacks and disadvantages lurking in the whole thing which will be found to declare themselves, but I cannot see why it should be so. A lime-hating plant would never begin its course by simulating the greatest prosperity. And it does not look now as if these Oncocyclus Irises had the smallest objection to the treatment they have received. On the contrary, they seem to be greatly benefited by it. The following, among others, are in my frames:—*Iris Gatesii*, *I. Lorteti*, *I. susiana*, *I. Bismarckiana*, *I. lupina*,

I. urmiensis (fig. 170), *I. iberica*, &c.; and those about which at present success is least marked are *I. paradoxa* and *I. urmiensis*, but this may, perhaps, come from the fact that they naturally succeed the former, and a little time may show that they are all doing equally well. It should, perhaps, be said here—as this is supposed to be a paper about the cultivation of Oncocyclus Irises—that while so great an emphasis has been laid on the use of lime in the beds where they are growing, it is not meant at all that this can do away with all the other and ordinary precautions to which we have been accustomed until now. It is not right to say that lime is *per se* "the secret of success," but only that lime is indispensable

FIG. 170.—IRIS URMIENSIS. (*The Garden.*)

to it if other things be right, and if it be wanting, no other measures, however good they may be, will do. To this extent, but no more, it is "the secret of success." Let other things, then, be duly remembered; they are, as it seems to me, very briefly the following:—(1) Oncocyclus Irises are only likely to do well in a sunshiny place; a shady locality, or one overhung with trees, would not suit them at all. (2) They must have a shelter or covering over their heads in summer months, or else they will start off into growth much too soon and will not blossom the next year. (3) Drainage must be perfect; they would not endure to be waterlogged in any degree. (4) They like firm planting. I put boards over my beds

and my gardener stamps upon them till the soil beneath becomes as hard as a rock. (5) The rhizomes should be lightly covered over—just enough to protect them from frost. (6) The borders should be kept very free of weeds, or anything which can intercept the agency of the light.

FIG. 171.—IRIS 'PARAVAR.' (*Gardeners' Chronicle.*)

I believe that if these rules be attended to, and the plants be grown in soil which is impregnated with lime, very good results may be expected to follow. One thing is certain, which is this: Oncocyclus Irises

hate to be disturbed. They send down their great thong-like roots deep into the soil and anchor themselves very firmly in it, and because of this it may also be very confidently said that what is called the "taking-up system,"—which implies that the plants should be taken up out of the ground and kept on a greenhouse shelf for a few weeks or

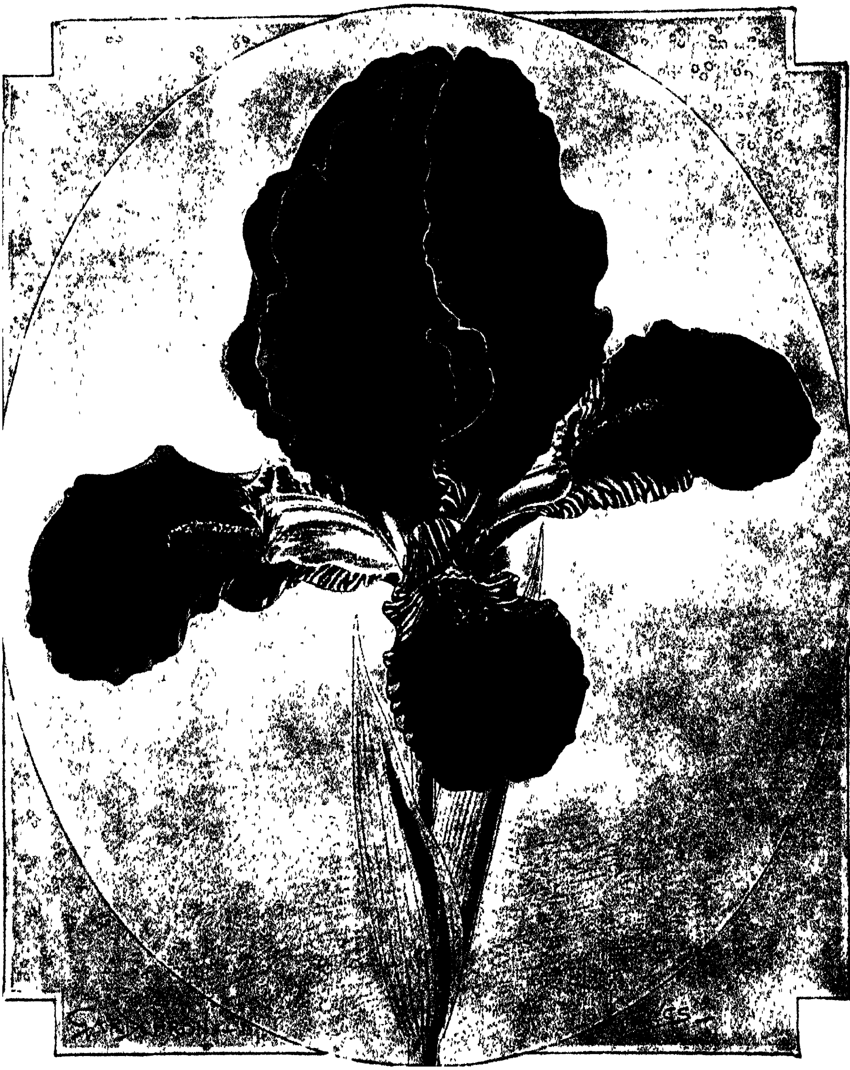


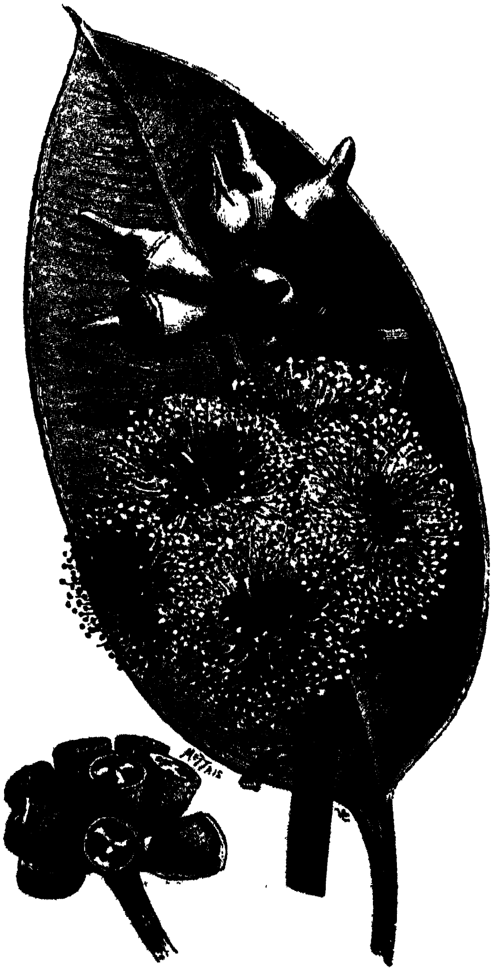
Fig. 172.—Iris 'Alkmene' ×. (*Gardeners' Chronicle.*)

months every year—cannot, from the very nature of the case, do so well as if they remained *in situ* and undisturbed.

It is believed that no one in England has any adequate idea of what these Irises can really do, because they have been worried so much and treated after a fashion which they are prompt to resent. So far as I know, Oncocyclus Irises have never yet remained in this country perfectly

undisturbed for long years together, and only when this comes off shall we really understand what their surprising beauty is like. It is noticeable about them that when they do well they do very well indeed; it is all neck or nothing, so to say, on their part. Let us hope that their secrets are now sufficiently disclosed, and that, after many years of great trouble which they have given, they will now, at last, be quite contented with their lot, and will graciously and liberally reward us for our pains.

Post-scriptum.—The figures are given of two very beautiful and interesting hybrids between the Oncocyclus and Pogoniris groups. Fig. 171, *Iris* 'Paravar' ×, is a cross between *I. paradoxa* and *I. variegata*, and in colour it resembles a dark form of *I. paradoxa* called *violacea*, though its other parent is disclosed in certain brown and tawny markings of the flower. Fig. 172, *Iris* 'Alkmene' ×, is a cross between *I. paradoxa* and *I. Swertii*. It is not unlike 'Paravar,' but has somewhat more brown in its colouring, particularly on the falls. It is hoped that these hybrids may prove easier of cultivation than the admittedly difficult Oncocyclus group.



ON SOME EXPERIMENTS IN THE CULTIVATION OF ONCOCYCLUS IRISES.

By JOHN HOOG (C. G. VAN TUBERGEN, jun., Haarlem).

FOR the past twelve years or so I have paid a special attention to the growing of the Oncocyclus class of Irises, which with me, as with so many growers, do well the first year after importation, but which on subsequent cultivation generally diminish gradually in health and strength, the end usually being an almost complete failure. Many and varied have been my experiments with these Irises. I planted the rhizomes early and late, on light and on heavy soils, in dry and in moist situations, and although every year I felt that I learned somewhat, still it was clear to me that some, for the time, insurmountable barrier yet lay between my efforts and success. At last, in 1898, I hit upon the idea of having some soil sent to me from the very spots where the Oncocyclus Irises grow wild. As I then happened to have a collector in the mountainous region stretching eastwards of the Armenian town of Van, whence I received a plentiful supply of various Oncocyclus Irises (the new *I. urmiensis*, *I. paradoxa* var. *Choschab* (fig. 173), and *I. lupina* var. *Schadach* among them), it was easy enough for me to have some of the original soil sent, together with a consignment of various bulbs and roots, from that district. This soil I sent to a competent chemist to be carefully analysed, and I did the same with my own garden soil. The two different analyses I have pleasure in communicating hereunder, and they may be said to represent a story without words, yet of the utmost importance:—

	Analysis of soil in which Oncocyclus Irises grow wild. Grammes per kilo soil	Analysis of Dutch Bulb garden soil. Grammes per kilo soil
Sulphuric acid (SO_3)	0·087	0·0812
Chlorine (Cl)	0·034	0·021
Phosphoric acid (P_2O_5)	0·044	0·656
Lime (CaO)	155·80	1·840
Magnesia (MgO)	49·56	0·516
Oxide of iron (Fe_2O_3)	30·78	5·240
Kali (K_2O)	0·198	0·206
Natron (Na_2O)	0·050	0·034
Alum (Al_2O_3)	7·581	traces

The great difference in the quantity of such an important factor in plant-life as lime is, which was found in the Dutch soil and in that from Armenia, made it clear to even the most uninitiated observer that no plant could be expected to feel happy in a ground containing not even two grammes of lime per kilo of soil, whereas this same plant naturally grows wild on sites with 155 grammes per kilo. This difference is immense, and so it is with the magnesia. Naturally the idea suggested itself that a great step in the right direction would be made if one

supplied lime and magnesia to soils which were wanting in both, and that, if possible, in a form which would be easily accessible to the roots of the Oncocycli. As is well known, the dolomitic limestone contains a high percentage of both lime and magnesia, and had it been possible for me to get it here, I would certainly have added it to my soil after having it ground to make it fine. The dolomitic limestone not being obtainable here unless at very great cost, I tried to get a marl containing as high a percentage of lime as possible, but found that most of the marl-used in agriculture also contained a dangerously high percentage of phosphoric acid, which being almost entirely absent in the Armenian soil, I deemed

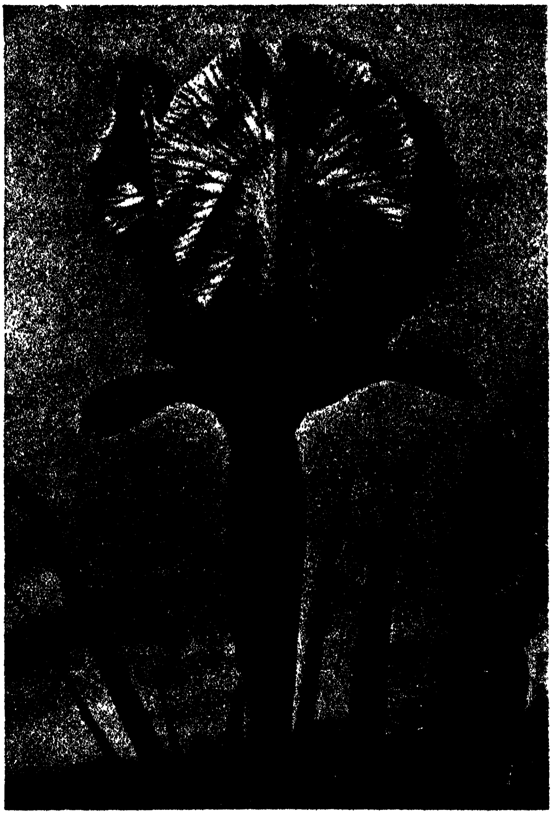


FIG. 173.—IRIS PARADOXA VAR. CHOSCHAB. (*The Garden*)

it unwise to add to my ground. Among many samples of marl one was at last found which only contained very feeble traces of the phosphoric acid, and this was consequently selected. To provide the magnesia the Grecian magnesite, which is easily enough obtainable, was added. The question now arose, how much of the lime-holding marl and of the magnesite was to be added to my soil; and this, of course, experiments only would show. Ten beds, each eight yards long by one in width, were set apart for experimenting with, and when the rhizomes of the Oncocycli were planted in November 1899, on the first bed a dose of five kilos of marl and two of magnesite was strewn between and

over the Iris rhizomes. This quantity was gradually increased on the remaining beds, so that to the last bed a maximum dose of thirty kilos of marl and fifteen of magnesite was applied.

It soon became evident that there was a marked difference between the formation of new roots emitted by the rhizomes planted on the prepared beds and those planted in our ordinary soil. In the latter case roots were forming slowly and sparingly, whereas on the marl and magnesite many more new roots were developing which also grew much faster. The difference in leaf-growth in the spring also became most strongly marked, and I never saw finer and healthier specimens of Oncocycli than my treated plants became in the course of the spring and summer of 1901.

The experiments also showed that in my Haarlem soil (moist, well-enriched sand) there was no difference in the growth made by plants in beds to which the maximum dose (thirty kilos of marl and fifteen kilos of magnesite) had been added from those on the bed with twenty kilos of marl and nine of magnesite, but there was a marked difference in the luxuriant growth of the Irises on the beds with the maximum dose and on the first bed, which contained only five kilos of marl and two of magnesite.

The size and quality of the rhizomes grown on the marl and magnesite, when lifted in July, fully corresponded with the fine leaf-growth the plants had made, and I then felt confident that a very great stride had been made forward on the road to success. On our ever-moist Dutch soil I had found it necessary to take up the rhizomes of the Oncocyclus Irises every year after the growth is finished in July, for if we do not do so the moist subsoil causes the rhizomes to start growing again at once, so that when winter sets in the plants have tender young shoots from three to four inches long, and these inevitably fall a prey to frost or get damped off if the winter is moist and misty. I now wanted to find out how these treated Irises which had made such a surprisingly fine growth would behave if I left them untouched, as, of course, the value of the Oncocycli as garden plants would be so much greater if one could leave them out all the year round, like the ordinary classes of garden Irises. The best three beds with the marl and magnesite (each bed containing about fourteen different species) were consequently left untouched, and the unexpected result has been that, although the rhizomes showed a little leaf-growth in the autumn, which is natural to them, they passed through this last (severe) winter splendidly, and these plants are now in a highly satisfactory condition. Also the rhizomes grown on the marl and magnesite, which had been taken up in July and replanted last November, although, of course, in development much behind the untouched ones, are all in a very good condition. I do not, of course, pretend that my experiments, which only cover such a comparatively short time, have proved that all the difficulties to be surmounted in the cultivation of the Oncocyclus group of Irises have been overcome, but, whilst it is quite certain that these Irises cannot exist where there is not an abundance of lime and magnesia in store for them, it is equally certain that they can be made to flourish if these two substances are supplied in due proportion.

MIMETIC RESEMBLANCES AMONG PLANTS.

By Rev. Prof. G. HENSLOW, M.A., V.M.H., &c.

[July 2, 1901.]

INTRODUCTION.—Mimetism, as it has been called, is a well-recognised feature among animals. One animal, as a butterfly, may superficially resemble another in form and colour, but have no real or close affinity with it. Others, as the *Kalima Inachis* of India, when its wings are closed, look like dead leaves. Caterpillars on Willows, &c., resemble bits of broken twigs, &c. Again, in Australia, which had originally only Marsupials among mammals, Nature has evolved out of that one family genera which elsewhere form separate groups of mammals, such as the carnivora, insectivora, rodents, &c. Even a mouse finds its exact counterpart in a pouched little animal of precisely the same form (*Antechinus minutissimus*). Lastly, all animals of whatever kind that frequent the deserts have acquired a similar tawny colour to that of the sand; and Arctic animals are white when they are surrounded by snow. But illustrations are too numerous to mention, and can be taken from all groups of the animal kingdom.

In the vegetable kingdom, resemblances between plants of no affinity are extremely common, and the obvious reason is that they live under the same or similar climatal conditions. In the animal kingdom the cases of the resemblances to each other are equally numerous; but the general inference applies to all, viz. that the mimetic resemblances are presumably the result of such animals living under identically the same conditions and so becoming influenced by their environments. Mimetism among plants is best seen in those living under surroundings of some pronounced character, and will be well illustrated in the following examples:—

Desert Floras.—Certain types of plants are very characteristic of hot, dry, sandy, or rocky localities, where rain falls but seldom, and water must be stored up against the dry season lasting for some nine months or so. Under these circumstances stems or leaves become thick and fleshy, and provision is made in the anatomical structure of the surface to resist undue loss of water by transpiration.

As remarkable examples take the members of the Cactus family of Mexico, which have thick, massive, angular stems, the leaves being wanting, but represented by spines. Precisely similar stems occur in the Euphorbias of the Soudan, &c., and again in the Stapelias of South Africa, and other plants of other orders. These coincidences are obviously due to the plants responding to the external influences of their environment and assuming similarly adaptive structures.

Another feature is the spinescent type. Branches and leaves become represented by spines in many different plants in deserts; just as the Gorse and Needle-furze (two distinct genera) are spiny on our own heaths, as well as the Rest-harrow by the roadsides. This spinescence is

simply the result of a deficiency of water, for if the Rest-harrow be grown in moist earth and air its spines soon cease to be formed.

Another type of foliage in dry regions is the "Ericoidal" or Heath-like form. The leaf consists of a small narrow blade, more or less pointed. In South Africa, more especially on the western side, Heaths abound; but in Australia, where similar conditions occur, *Epacris* "represents" Heaths by assuming a very similar appearance. Indeed, many other plants there, of quite different families, have a similar Heath-like foliage.

Mountainous Types.—One of the forms of foliage assumed by plants of widely different families in far-distant parts of the world is the "Cupressoidal" or Cypress-like foliage. The leaves are almost microscopically minute, and closely adpressed against the branch. The common Thuyas, Retinosporas, and Junipers of our shrubberies, whether from Japan or California, are examples. It is mimicked by our own Ling growing with heaths. It occurs in the Clubmosses on Snowdon, and some most remarkable mountain forms of *Veronica* in New Zealand possess it as well. As drought appears to be one of the direct causes of this diminished type of foliage, it is not surprising to find it mimicked in the African deserts by *Salsola Pachoi*, &c. So too, in the Antarctic regions, it is exactly paralleled by that of *Drapetes muscosa* (Thymelaceæ), *Bolax Glebaria* (Umbelliferæ), *Lyallia kerguellensis* (Caryophylleæ), and *Forstera clavigera* (Stylideæ).

Muscoidal Type.—This is one of the extreme forms of high Alpine as well as of Arctic and Antarctic regions. Besides some species of *Veronica* in New Zealand mountains, there are *Saxifraga bryoides*, *S. muscoides*, *Cherleria sedoides*, *Silene acaulis*, &c. Again, *Bolax Glebaria* (Umbelliferæ), of the Falkland Islands, is mimicked by species of *Acanthophyllum* (Caryophylleæ) in Afghanistan, and by *Haastia* (Compositæ) in New Zealand.

A gradual reduction may thus be seen from the long and pointed leaf of a Heath to the short and pointed one of Juniper. Then, the point is suppressed and the Cupressoidal type is obtained. These two last-named forms often occur on the same bush, as of Junipers, Retinosporas, &c.; the more pointed form, being the younger on the bush, corresponding to the earlier condition in point of evolution. Lastly, the Cupressoidal leaf is still further reduced, and a form is reached resembling that of *Salicornia.*

Linear Types.—When plants grow in massive tufts or are crowded socially, so that the blades of the leaves are compelled to stand erect, they take on very much the same form. A grass-leaf may be regarded as the type. This is closely imitated by the Grass-leaved Pea (*Lathyrus Nissolia*), which grows among grass. The same linear form is seen in Pinks, Carnations, and Thrift.

In all cases the anatomy corresponds with the form; in that, while in broad and horizontally situated leaves the stomates are altogether or mostly on the underside, they are equally distributed on both sides of erect-growing leaves. It reveals an obvious fact, that the form and structure of such erect leaves, as compared with broader and horizontal blades, is simply the outcome of the position which they are compelled to

take with reference to incident light. Indeed, experiments have shown that leaves will be broader or narrower as the amount of light is greater or less which is allowed to fall upon them.

Aquatic Types.—The form most common in Dicotyledons which have submerged leaves is for them to be finely dissected; though as soon as the stem reaches the surface of the water, it may develop more or less lobed or entire leaves, as may be seen in the Water Crowfoot (*Ranunculus heterophyllus*).

Now this form of leaf is imitated by many aquatic plants of no affinity, as in *Cabomba* (Nymphæaceæ), *Myriophyllum* (Halorageæ), *Hottonia* (Primulaceæ), *Apium inundatum* (Umbelliferæ), *Ceratophyllum* (Ceratophylleæ), &c. Affinity among these plants is quite out of the question, but since the Water Crowfoot is undoubtedly descended from some terrestrial Buttercup, and the *Halorageæ* are aquatic forms of *Onagraceæ*, and *Hottonia* is allied to land Primroses, &c., the inductive evidence is ample to prove that this type of submerged foliage is entirely due to the direct and arresting action of the aquatic medium, which brings about degradations, not only in the leaves, but throughout the entire plant.

Another type of submerged leaf is ribbon-like. This is seen in *Lobelia Dortmanna*, *Hippuris*, &c., but it is commoner among Monocotyledons. From these, as in *Sagittaria*, we learn that this form is really phyllodinous, as long as it is in deep water; but when the surface is reached, the long strap-shaped phyllode develops a blade at the summit. This is at first oval, then it becomes hastate, and finally sagittate when completely out of water, giving the name "Arrowhead" to the plant.

Now it has been found that when a phyllode was on the point of developing the oval blade at the summit and the water became suddenly deepened, it at once began to grow out further into the linear form. Indeed, the writer has a specimen in which the three points of the sagittate leaf have elongated into long narrow ribbon-like extremities, doubtless from the same cause.

Turning to the *Nymphæaceæ* of Dicotyledons, the development of the leaves of *Victoria regia* follows a similar procedure. The first leaves only develop phyllodes, then a hastate blade is produced, and finally an orbicular one which floats on the surface of the water.

In the Lotus (*Nelumbium*) the lower lobes unite and a peltate leaf is produced. In Monocotyledons the rounded stage in the development of the leaf is seen in the Frog-bit, and the united basal portions of the hastate leaf in *Caladium* &c. resemble a similar union in the Lotus.

Taking all these and other facts into consideration, the conclusion is inevitable that similar structures, often mimetic in form, seen in aquatic flowering plants are simply the result of self-adaptation to the aquatic medium in which the plants live.

Specialised Mimetic Organs.—In the preceding cases the connection between the plant-structure and the influence of the environment is obvious; but in those which follow, though one may be convinced that like causes have produced like effects, it is not so easy to say why any particular structure occurs in preference to another, which might have been equally serviceable.

Climbing Plants.—The methods of climbing are numerous, but the only ones that need be selected in illustration of mimetism are the following :—

The tendril of a Pea is readily seen to be a metamorphosed leaf; several of the leaflets may still remain perfect, while the rest are represented by their midribs alone, now much elongated and highly sensitive to touch, so that they coil round anything they can grasp.

If this be compared with a much branching tendril of a Vine a strong similarity will be seen, but this latter is a metamorphosed flowering branch and not a foliar organ at all, though it climbs in a similar way to the tendril of a Pea.

The tendril of Bryony is also foliar in its origin, but consists of a single thread, which, as soon as the apex has caught anything, coils up into a corkscrew-like structure, but having some of the coils turning in one direction, the remainder, about an equal number, turning in the opposite direction.

In the Passion-flower the long slender tendril represents a flowering branch, but it is in form and behaviour precisely the same as in the Bryony.

Ascidiform Type.—Perhaps no better illustration of plant mimicry could be given than that between the pitcher of *Cephalotus follicularis* and that of the many species of *Nepenthes*. These two genera represent two totally distinct families, and imply long and now lost ancestries. The general appearance of their mimetic pitchers is precisely the same in both. There is a similar "lid," a pitcher of the same shape, with an inrolled margin, glands being sunk into the surface of the lining of the pitcher, which externally carries a fringed guide from bottom to top. Yet, while the pitcher of *Cephalotus* is a metamorphosed leaf-blade, that of *Nepenthes* is developed out of a water-gland, situated at the apex of the blade, this latter taking no part in its formation whatever.

Such complete case of mimicry as this is quite as astounding as any between two kinds of insects, or between the "kangaroo mouse" and the genus *Mus*.

Conclusion as to Mimetic Vegetative Organs.—The above-mentioned selection of cases is but a sample of what may be regarded as a general principle in nature, which is, that since the living protoplasm is of one and the same kind in all beings, as far as we know, where a certain feature is evolved, a similar one may be expected under similar conditions, and a mimetic organ is the result: that is, so far as the conditions of the structure will allow. Thus the kangaroo mouse mimics a true mouse, but retains its pouch and insectivorous teeth; so a linear dicotyledonous leaf (as of *Lathyrus Nissolia*) resembles the monocotyledonous grass-leaf, but retains its branching venation.

Floral Mimicry.—It is not at all uncommon to find one flower imitating another of a quite different family. Thus, bracts are often white or coloured other than green, and, so to say, answer for and do duty as a corolla, as in *Poinsettia*, *Euphorbia*, and some umbelliferous plants, as *Astrantia*, and in the "Everlastings" among *Compositae*. But the imitation may be much more exact, and indeed so close as easily to deceive the unwary. Thus some species of *Cornus* have four white bracts

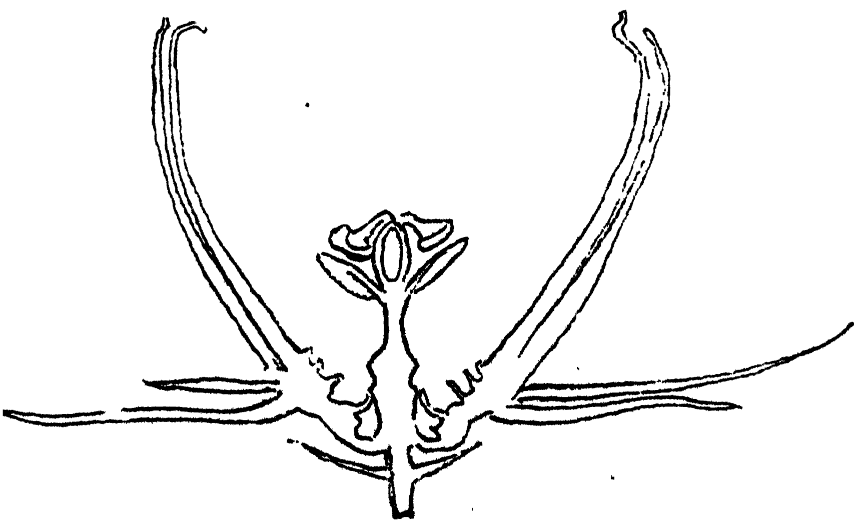
below numerous minute, inconspicuous, but complete flowers, and the whole inflorescence then looks exactly like a white-flowered *Clematis*. *Darwinia tulipifera*, as the name implies, has an inflorescence with coloured bracts closely resembling a Tulip in colour and size. *Euphorbia jacquiniæflora* has five scarlet lobes on the rim of the involucral cup, thereby mimicking a corolla with five petals.

The form of the corolla may be much the same in plants of widely distinct families. Thus the papilionaceous corolla of the *Leguminosæ* is imitated by the so-called "falsely papilionaceous" one of *Polygala*. It is also seen in the gamopetalous corolla of *Coleus* (Labiatæ) and *Collinsia* (Scrophularineæ). In all these the front petal is horizontal and closes over the stamens and pistil.

A similar-shaped corolla is seen in some species of Pelargonium (*Hoarea* section). Again, a spike of flowers of an Orchid (*Disa Cooperi*) is very like one of a Larkspur with its upturned and elongated spur.

Lastly, *Crocus* (Irideæ), *Sternbergia* (Amaryllideæ), and *Colchicum* (Liliaceæ) have precisely similar perianths, though they belong to as many different families. The general cause of such similarities in flowers is *presumably* in consequence of similar insects having been the regular visitors of such flowers as have assumed forms so closely resembling one another.

General Conclusion.—When all the above facts (and many more might have been given) are considered together, and when it is noted that in many cases experimental verification shows that the peculiarities in question are the results of the definite or direct action of the environment, the inductive evidence is overwhelming that mimetic results are in all cases the consequence of the environment influencing the protoplasm to adaptive response. It will thus be seen that natural selection is quite uncalled for, and, in fact, has no *raison d'être* in the *origin* of any structure whatever.



OFFICIAL REPORT

OF THE

CONFERENCE ON LILIES.

July 16, 1901.

On Tuesday, July 16, 1901, an exhibition of Lilies was held at Chiswick, followed by a Conference upon them. The usual Committees met at 11 o'clock in the great Vinery where the flowers were exhibited. As a general rule it is invidious and unfair to make special mention of any particular exhibit, but on this occasion the honours of the day, as far as Lily flowers were concerned, fell so conspicuously to Messrs. Wallace of Colchester that it would be unfair not to make particular mention and acknowledgment thereof. Messrs. Wallace staged a magnificent collection of Lilies (fig. 174), in which probably more species and varieties were represented than have ever anywhere or at any time before been brought together, and the thanks of all Fellows of the Society were very obviously due to them therefor, as also for a very large proportion of the flowers used to illustrate this report.

The work of the Committees (whose recommendations will be found recorded at the usual places) having been finished, they all sat down to luncheon at one o'clock with the invited guests of the Conference, to the number of nearly two hundred, the President of the Society, Sir Trevor Lawrence, Bart., in the Chair. After the usual loyal toasts had been duly honoured, Sir Trevor cordially welcomed the special members and guests of the Conference, combining therewith an acknowledgment of the deep debt of gratitude which the whole Society owes to the members of the various standing Committees, whose very good health he proposed. The toast was very interestingly responded to by Mr. Alexander Dean.

Luncheon ended, an adjournment was made for half an hour whilst the tables were removed and the tent arranged for the Conference, which assembled at half-past two o'clock under the Presidency of Mr. H. J. Elwes, F.R.S., V.M.H., the well-known author of the magnificent monograph on Lilies.

FIG. 174.—MESSRS. WALLACE'S GOLD MEDAL GROUP OF LILIES. (*Journal of Horticulture.*)

The following gentlemen had been asked kindly to contribute papers or notes to the Conference:—

Mr. J. G. Baker, F.R.S., V.M.H., Kew.
Dr. Bonavia, Worthing, Sussex.
Mr. Luther Burbank, California.
Mr. F. W. Burbidge, M.A., V.M.H., Dublin.
Mr. W. Goldring, Kew.
Dr. Henry, China.
Mr. H. Jonas, Whyteleaf, Surrey.
Heer Ernst Krelage, Haarlem, Holland.
Mr. J. Carrington Ley, East Farleigh, Kent.
Mr. George Massee, Kew.
Mr. G. L. Patey, Newton Abbot, Devon.
Mr. Carl Purdy, California.
Captain Savile Reid, Yalding, Kent.
Mr. F. W. Seers, India.
Mr. R. Wallace, Colchester.
Mr. G. F. Wilson, F.R.S., V.M.H., Weybridge Heath, Surrey.
Mr. George Yeld, M.A., York.

Fig. 176.—Lilium Wallichianum superbum. (*Journal of Horticulture.*)

(To face page 335)

DESCRIPTIONS OF THE NEW SPECIES AND PRINCIPAL VARIETIES OF LILY DISCOVERED SINCE THE PUBLICATION OF THE MONOGRAPH OF ELWES (1880).

By J. G. Baker, F.R.S., V.M.H.

Section Cardiocrinum.

L. mirabile, Franchet in *Journ. de Bot.* vi. (1892) 310. Stem slender, about 4 ft. long. Leaves alternate, thinly papyraceous, cordate-ovate, acute. Inflorescence centrifugal, composed of 7–15 flowers, spreading horizontally, all shortly peduncled. Perianth funnel-shaped, 5–7 in. long; segments oblanceolate, above an inch broad, narrowed gradually from above the middle of the base, white outside, tinged with violet towards the margin. Stamens half as long as the perianth; anthers short, golden yellow. Pistil more than half as long as the perianth; ovary an inch long. Capsule subglobose, under 1½ in. long and broad. Seeds like those of *L. cordifolium* in shape, but not above half the size.

Western China; province Szechuen, district of Ichen-keou-tin; collected by Father Farges. Differs from *L. cordifolium* by its centrifugal inflorescence (a character previously unknown in the genus), globose capsule, and small seeds.

Fig. 175.- L. cordifolium.

L. Glehni, F. Schmidt, *Reise Amur. und Insel Sachal.*, 187. Said to differ from *L. cordifolium* by its more numerous smaller flowers (4 in. long) and valves of the capsule 1-nerved on the back.

Island of Sachalin, north of Japan. Collected by Glehn and Albrecht in 1861. Probably should be regarded as a northern variety of *L. cordifolium* (fig. 175).

Section Eulirion.

L. sulphureum, Baker in *Bot. Mag.* t. 7257; Hook. fil. *Fl. Brit. Ind.* vi. 351; *L. Wallichianum* var. *superbum*, Hort. Low (fig. 176); Baker in *Gard. Chron.* 1891, ii. 480; *L. ochroleucum*, *Garden*, 1891, ii. 338, non

Wallich. Bulb large, globose. Stem stiffly erect, cernuous at the apex, 6–7 feet long. Leaves numerous, scattered, spreading, linear, bright green, the lower half a foot long, the upper with bulbillæ in their axils. Flowers usually 2–3, pendant on long peduncles. Perianth funnel-shaped, 6–7 inches long, sulphur-yellow, tinged outside with claret-red, unspotted; segments oblanceolate, spreading in the upper fourth, the inner nearly twice as broad as the outer. Stamens 1½ inch shorter than the perianth; anthers about an inch long; pollen red-brown. Style much overtopping the anthers.

Shan States, Upper Burma. First received at Kew in a living state in flower from Messrs. Low & Co. in 1891. Nearly allied to the Central Himalayan *L. Wallichianum*, which has pure white flowers, slender anthers, with yellow pollen, and no bulbillæ in the axils of the upper leaves.

L. primulinum, Baker in *Bot. Mag.* t. 7227; Hook. fil. *Fl. Brit. Ind.* vi. 351; *L. neilgheriense*, Collett & Hemsl. in *Journ. Linn. Soc.* xxviii. 138, non Wight; *L. claptoniense*, Hort. Low. Bulb large, globose; scales lanceolate. Stem stiffly erect, glabrous, 3–4 feet long. Leaves numerous, scattered, ascending, linear or lanceolate, sessile, glossy green, glabrous, the lowest 4–5 inches long; bulbillæ none. Flowers 2–3 in the wild plant, on long ascending peduncles. Perianth funnel-shaped, pale yellow, unspotted, 5–6 inches long; segments reflexing when expanded from nearly half-way down, oblanceolate, the outer ¾ inch broad above the middle, the inner nearly twice as broad. Stamens rather shorter than the perianth; anthers linear, ¾ inch long; pollen brown. Style as long as the perianth.

Shan Hills, Upper Burma. First collected by Sir H. Collett in 1888, and sent by Mr. Boxall to Messrs. Hugh Low & Co., with whom it flowered in 1889. Differs from *L. neilgheriense* by its shorter and more open perianth-tube, brown pollen, and style as long as the perianth.

L. Bakerianum, Collett & Hemsl. in *Journ. Linn. Soc.* xxviii. 138, t. 22; Hook. fil. *Fl. Brit. Ind.* vi. 350. Stem slender, pubescent, 2–4 feet long. Leaves laxly disposed, sessile, linear, ascending, glabrous on the upper surface, densely pubescent beneath, the upper 1½–2 inches long. Flowers 2, on long erect peduncles, with a single leaf from the middle. Perianth funnel-shaped from a broad base, 3½–4 inches long, white, with copious brown spots inside in the lower half; segments spreading in the upper quarter; outer oblanceolate, ¾ inch broad above the middle; inner, about an inch broad. Stamens 2 inches long; anthers linear, yellow, ½ inch long. Style overtopping the anthers.

Shan Hills, Upper Burma, alt. 4,000 feet. Collected by Sir H. Collett in June, 1888. It was also collected by D. Burke when travelling in Upper Burma for Messrs. Veitch, and at an elevation of 6,000 feet in Yunnan by Dr. Henry. Resembles *L. odorum*, Planch., in the shape of the perianth. Differs by its very narrow, stiffly erect leaves, densely pubescent beneath, and flowers copiously spotted with brown inside in the lower half.

L. Lowii, Baker in *Bot. Mag.* t. 7232; Hook. fil. *Fl. Brit. Ind.* vi. 350; *L. nepalense*, Collett & Hemsl. in *Journ. Linn. Soc.* xxvii. 138, non Wight. Bulb globose, 2 in. diameter; scales lanceolate, small.

FIG. 177.—LILIUM LOWII. (*Gardeners' Chronicle.*)

(To face page 337.

Stem glabrous, stiffly erect, 3-4 ft. long. Leaves numerous, scattered, linear, sessile, glabrous beneath, the lower 3 in. long. Flowers 3 on long cernuous peduncles, with a leaf from the middle. Perianth openly funnel-shaped, 3-3½ in. long, white, with a slight green tinge on the outside, white copiously spotted with small red-brown dots in the lower half of the inside; segments reflexive in the upper third or half, inner much narrower than the outer. Stamens an inch or more shorter than the perianth; anthers linear, ½-¾ in. long; pollen brown. Style as long as or longer than the stamens. (Fig. 177.)

Shan Hills, Upper Burma. Collected by Sir H. Collett in 1888, and sent by Mr. Boxall to Messrs. Low & Co., with whom it flowered in 1889. After studying the fine series of specimens collected by Dr. Henry and Mr. W. Hancock, F.L.S., in the province of Yunnan, Western China, I do not think this can be kept up as distinct from *L. Bakerianum.*

L. rubellum, Baker in *Gard. Chron.* 1898, ii. 32, fig. 128; *Bot. Mag.* t. 7,684. Bulb globose, middle-sized; scales lanceolate. Stem slender, green spotted with brown, 1½-2 ft. long, laxly leafy from the base to the apex. Leaves oblong-lanceolate, 2-3 in. long, firm, bright green, glabrous, distinctly 3-5 nerved. Flowers few, corymbose, erect. Perianth funnel-shaped, pink, unspotted; segments oblanceolate-oblong, obtuse, spreading in the upper half, the three inner an inch broad, the outer narrower. Stamens much shorter than the perianth; anthers linear, ½ in. long; pollen yellow. Style overtopping the anthers.

Japan. First received at Kew in February 1898, from Messrs. Bunting, of Chelmsford, whose stock was purchased by Messrs. Wallace, of Colchester. A very distinct and beautiful species. (Fig. 192.)

L. japonicum, Thunb., var. *L. Alexandræ*, Hort. Wallace; Baker in *Gard. Chron.* 1895, ii. 86, fig. 44. Bulb like that of *L. longiflorum.* Stem green, glabrous, stiffly erect, 1½-2 ft. long. Leaves scattered, lanceolate, green, glabrous, distinctly 5-nerved, narrowed at the base to a short flattened petiole, the central ones 3-4 in. long by an inch broad. Flowers 2-3; peduncles 1-2 in. long, much thickened upwards. Perianth openly funnel-shaped, pure white, slightly tinged with green outside towards the base, 5-6 in. long, 7-8 in. diameter when fully expanded; inner segments oblong, 2 in. broad, outer much narrower. Stamens 2 in. shorter than the perianth; anthers linear, ½-⅝ in. long, dark brown; pollen yellow. Style overtopping the anthers.

Japan. Exhibited both by Messrs. Veitch and Wallace at Chiswick, in July 1898. Differs from the type by its broader leaves and longer style. (Fig. 178.)

L. leucanthum, Baker; *Garden*, 1895, xlvii. p. 97 (plate); *L. Brownii* var. *leucanthum*, Baker in *Gard. Chron.* 1894, xvi. 180; Hook. fil. in *Bot. Mag.* t. 7722. Bulb large, globose. Stem 3-4 ft. long, stiffly erect, green, glabrous. Leaves very numerous, lanceolate, sessile, ascending, bright green, glabrous, the lower 8 in. long by ½-¾ in. broad, the upper shorter and broader, with bulbillæ in their axils. Perianth funnel-shaped, 6 in. long, milk white, slightly tinged with green towards the base outside, unspotted, tinged with pale yellow towards the base inside; segments spreading only in the upper third, the outer lanceolate, an inch broad, the inner oblong-lanceolate, 2 in.

broad. Filaments 4 in. long, densely pubescent in the lower half; anthers ½ in. long; pollen bright brown. Ovary clavate, 1½ in. long; style overtopping the anthers.

Ichang gorge of the Yang-tze-kiang. Discovered by Dr. Henry in 1888. Differs from *L. Brownii* by having no tinge of brown on the outside of the flower, and by having a few bulbillæ in the axils of the upper leaves. *L. kewense*, W. Watson, figured in *Gard. Chron.* February 16, 1901, is a hybrid between *L. Henryi* and *L. Brownii* var. *chloraster*.

L. longiflorum var. *formosanum*, Baker in *Gard. Chron.* 1880, ii. 528. Differs from the Continental type by its more numerous, longer, narrower leaves, with never more than three veins, and all the six segments of the perianth distinctly keeled with red. Collected by Consul Swinhoe as far back as 1862; brought into cultivation by Mr. Maries in 1880, when collecting for Messrs. Veitch. For further notes on the varieties of *L. longiflorum*, see *Gard. Chron.* 1891, ii. 225.

L. Brownii var. *L. odorum*, Planch. More delicate than the type, with flowers less tinged with brown on the outside; bulb white or yellowish, not brown, with narrower scales; green, not reddish-brown stems, and less glossy leaves. Var. *chloraster*, Baker, collected by Dr. Henry in Central China, with *L. Henryi*, in 1888, differs from the type by its narrower perianth-segments, distinctly keeled with green both inside and out, and more slender style. In *Gard. Chron.* 1891, ii. 225, I have described four varieties of *Brownii*, viz. *odorum*, *chloraster*, *platyphyllum*, and *viridulum*.

L. Brownii var. *chloraster*, Baker in *Gard. Chron.* 1891, ii. 225. Stem 3 feet long. Leaves about 40, lanceolate, rather glossy, 3 in. long, ¼–⅓ in. broad. Flowers 3–4. Perianth openly funnel-shaped, 5 in. long, beginning to reflex an inch from the top, the throat of the funnel 2½ in. diam.; segments of both rows showing a distinct green keel both inside and outside, tinged with brown on the outside towards the base. Anthers as in the type, ¾ in. long, with bright red pollen; filaments pubescent.

Central China; Ichang gorge, with *L. Henryi*. Collected by Dr. Henry in 1888.

L. formosum, Franch. in *Journ. de Bot.* vi. (1892) 318. Stem 3 ft. long, slender, glabrous. Leaves subsessile, lanceolate, the longest half a foot long by an inch broad. Flowers 1–2, erect. Perianth broadly funnel-shaped, white, 6–7 in. long; segments oblanceolate, 1¼–1½ in. broad above the middle, spreading only towards the tip, inside towards the base densely pubescent on the nectariferous keel. Stamens but little shorter than the perianth; filaments papillose below the middle; anthers oblong, ⅓ in. long; pollen yellow. Style reaching to the tip of the segments. Capsule oblong, 2 in. long.

Western China; province of Szechuen, in the mountains of Ichen-keou-tin, collected by Father Farges. Nearest *L. Brownii* in the shape of the flower; differs by its flower white outside, longer stamens and yellow pollen. It agrees with *Brownii* in its papillose filaments and nectaries.

L. myriophyllum, Franch. in *Journ. de Bot.* vi. (1892) 318. Bulb of *L. longiflorum* and *Brownii*. Stem 3–6 ft. long, stout, densely leafy. Leaves linear, ascending, above 200 to a flowering stem, 1-nerved, very

Fig. 178.—Lilium japonicum var. Alexandrae. (*Journal of Horticulture.*)

(To face page 338.)

acute, with revolute edge, the upper in sterile stems bearing bulbillæ in their axils. Flowers usually two, erect, shortly peduncled. Perianth narrowly funnel-shaped, white, tinged with green outside, half a foot long; segments oblanceolate, but little spreading, an inch broad; nectary very broad, glabrous. Stamens nearly as long as the perianth; filaments glabrous; anthers oblong; pollen yellow. Style reaching to the tip of the perianth.

Western China: province of Yunnan; stony ground at Mo-so-yu; collected by Delavay in 1888. Nearly allied to *L. longiflorum*. Differs by its narrow perianth-segments, long stamens and style, and narrow, very numerous leaves.

Section Isolirion.

L. elegans, Thunb., var. *Batemanniæ*, Hort. Stem 2 ft. long. Flowers 3-5, large, open, clear apricot-red, without any spots or markings. Japan. (Fig. 211.)

Section Archelirion.

L. Henryi, Baker in *Gard. Chron.* 1888, iv. 660; 1890, viii. 380, with fig.; *Bot. Mag.* t. 7177; *Journ. Hort. Soc.*, n.s., xxvii. 191 (fig.). Bulb large, globose; outer scales oblong, 2-3 in. long. Stem below the inflorescence 5-6 ft. long, stiffly erect. Leaves sessile, lanceolate, the lower 6-8 in. long, above an inch broad, bright green, glabrous, without any bulbillæ in their axils; upper growing gradually smaller. Inflorescence finally reaching 1½ ft. long and a foot broad; peduncles spreading, with an ovate reduced leaf at the base, the lower sometimes branched. Perianth yellowish-red, 3 in. long; segments lanceolate, obtuse, reflexing from low down, with copious minute red-brown spots, and towards the base a green keel, with a few large club-shaped yellow papillæ. Stamens equally arcuate, nearly as long as the perianth; anthers linear, ¾ in. long; pollen bright orange. Style as long as the stamens. Capsule oblong, 1½ in. long.

Discovered in the Ichang gorge of the Yang-tze-kiang river, in the centre of China, by Dr. Henry in 1888. A most distinct and beautiful species, now widely spread in English gardens.

L. speciosum var. *gloriosoides*, Baker in *Gard. Chron.* 1880, ii. 198. Differs from the varieties already known by its narrower leaves, much reflexed crisped perianth segments, and scarlet rather than crimson spots and papillæ, which are mainly confined to the third quarter of the segment, beginning to count from the top downwards.

Central China; province of Kiu-kiang, in mountains near the "Heavenly Pool." Collected by Mr. Maries for Messrs. Veitch in 1879.

L. auratum var. *tricolor*, Baker in *Gard. Chron.* 1880, xiv. 198. Differs from the type by its more robust habit, broader suberect leaves, the upper 6-8 in. long, 2 in. broad, with 11-13 pellucid veins and larger flowers, without any brown dots, but with copious spots and papillæ the same colour as the lamina.

L. auratum var. *platyphyllum*, Baker, loc. cit. Differs from the type by its dwarf habit, broader leaves (the upper 2 in. broad), and very

broad perianth-segments, with spots as in the type, but less copious and more concentrated towards the centre of the segment.

Both these varieties came from a small island on the south-east of Nippon (Japan), and were collected by Mr. Maries for Messrs. Veitch. For an account of the other varieties of *speciosum* see T. Moore in *Gard. Chron.* 1874, 323.

L. oxypetalum, Baker. In "Flora of British India," vol. vi. p. 352, Sir J. D. Hooker, following Royle, refers this to *Fritillaria*. He separates as a distinct species the plant figured as *F. oxypetala* in *Bot. Mag.* t. 4731, which has narrower leaves and smaller flowers than Royle's type, under the name of *Fritillaria Stracheyi*. *L. nanum*, Klotzsch, placed by Sir J. D. Hooker as a doubtful species, is, I believe, identical with *Fritillaria Gardneriana*, Wall.

L. Delavayi, Franch. in *Journ. de Bot.* vi. (1892), 314. Rootstock a long, slender rhizome. Stem slender, pubescent, 1-2 ft. long. Leaves laxly disposed, sessile, ascending, oblanceolate, acute, 1½ in. long, ¼ in. broad, varying to linear, about 3 in. long, 3-nerved, densely papillose on the ribs and edges. Flowers usually solitary, rarely 2-3, drooping. Perianth openly funnel-shaped, wine-red, 2-3 in. long, with copious brown dots inside; inner segment oblanceolate, ¾ in. broad; outer narrower; nectary glabrous. Stamens half as long as the perianth; filaments glabrous; pollen yellow. Style twice as long as the ovary.

Western China; Yunnan. Collected in four different stations by Delavay in 1888. The alliance of this is, I think, with *oxypetalum*.

L. yunnanense, Franch. in *Journ. de Bot.* vi. (1892) 314. Bulb globose, 1½ in. diameter; scales oblong. Stem slender, glabrous, 1-2 ft. long. Leaves laxly disposed, sessile, linear, ascending, the longest 1½-2 in. long, ¼ in. broad, with revolute edges. Flowers 1-3, drooping, pink, unspotted. Perianth expanding widely, 1½-2 in. long; outer segments oblong-lanceolate, ¾ in. broad, inner oblong, an inch broad; nectary glabrous. Stamens not more than half as long as the perianth; anthers ⅙ in. long; pollen yellow. Style a little longer than the ovary, much overtopping the anthers.

Western China; province of Yunnan. Discovered by Abbé Delavay in 1887, and since collected by Messrs. Henry and Hancock, at Mengtze, at an elevation of 6,000 ft. A very distinct and pretty little species, allied to *L. oxypetalum*.

Section MARTAGON: Old World.

L. Jankæ, Kerner in *Oester. Bot. Zeit.* xxvii. (1877) 402; *L. pyrenaicum*, Baumg. *Enum. Strip. Transyl.* i. 301; non Gouan. Bulb 2 in. diameter; scales adpressed, lanceolate. Stem 2-3 ft. long, stout, stiffly erect, closely leafy. Leaves ascending, thin, lanceolate, the lower 3 in. long, ½ in. broad, the upper growing gradually smaller. Flowers 1-5. Perianth 2 in. long, pale yellow; segments oblanceolate, unspotted, reflexing from below the middle. Stamens much shorter than the perianth; anthers linear, ⅓ in. long. Pistil above an inch long. Capsule oblong-turbinate, with a distinct neck, 1½ in. long.

Mountains of Transylvania. Nearly allied to *L. pyrenaicum*, Gouan, and *L. albanum*, Griseb.

L. Heldreichii, Freyn; Boiss. *Fl. Orient*, v. 177. Bulb ovoid; scales lanceolate. Stem moderately stout, green spotted with purple, 2–3 ft. long. Leaves many, close, sessile, erecto-patent, glabrous, the lower 3–4 in. long, ½–¾ in. broad, the upper smaller and more erect. Flower solitary, bright reddish yellow. Perianth 2 in. long; segments oblanceolate, unspotted, reflexing from low down. Filaments an inch long; anthers linear-oblong, ⅓ in. long. Pistil shorter than the perianth. Capsule oblong-turbinate.

Mountains of Greece, alt. 6,000–8,000 ft. Collected by Von Heldreich, Sintenis and others. Intermediate between *carniolicum* and *chalcedonicum*.

L. ochraceum, Franch. in *Journ. de Bot.* vi. (1892) 319. Stem slender, 3–4 ft. long, smooth, shining, leafless in the lower part. Leaves all scattered, subpetiolate, the lower lanceolate, 2 in. long, ½ in. broad, the upper linear, 1-nerved. Flowers 1–3, yellow, unspotted, 2 in. long, cernuous, reflexing from low down; segments oblong-lanceolate, obtuse, ⅓ in. broad; nectary naked, glabrous. Stamens less than half as long as the perianth; anthers yellow. Style three times the length of the ovary.

Western China; mountains of the province of Yunnan, ascending to 9,000–10,000 ft. Collected by Delavay in 1883–7. Allied to *L. monadelphum* (*Szovitsianum*).

L. taliense, Franch. in *Journ. de Bot.* vi. (1892) 319. Stem slender, 6 ft. long, slightly scabrous with papillæ, leafless in the lower part. Leaves not very crowded, ascending, sessile, lanceolate, about 2 in. long, ¼–⅓ in. broad; the upper opposite or subverticillate, 1-nerved, very scabrous on the margin. Flowers 1–2, whitish, spotted or unspotted, 2 in. long; segments lanceolate, recurving from low down; nectary glabrous. Stamens and pistil not more than half as long as the perianth.

Western China; mountains of Yunnan. Collected in two localities by Delavay. Comes in between *L. Martagon* and *L. polyphyllum*.

L. Wallacei, Hort., *Garden*, 1897, fig. 1103. Bulb globose, 1½–2 in. diameter; scales thin, oblong, acute. Stem 1½ ft. long, green mottled with brown, densely leafy. Leaves crowded, sessile, ascending, linear, the central ones 3 in. long, ⅓ in. broad, bright green on the upper surface, 5-nerved. Flowers 2–3; lateral peduncles spreading widely. Perianth 3 in. long, bright pale scarlet, with a few small brown spots inside in the lower half; segments spreading from low down; inner ovate, with a short claw, an inch or more broad; outer much narrower. Filaments arcuate, 2 in. long; anthers linear, ½ in. long; pollen scarlet. Pistil as long as the stamens.

Japan. Intermediate between *L. elegans* and *L. Maximowiczii*. My description is drawn up from specimens sent by Mr. Wallace in August 1896.

L. Duchartrei, Franch. *Pl. David.* ii. 128; *Journ. de Bot.* vi. 316. Bulb small, borne at the end of a long slender rootstock; scales lanceolate. Stems very slender, 2–3 ft. long. Leaves scattered, thin, sessile, lanceolate, glabrous, the longest 2–2½ in. long, ⅓ in. broad at the middle. Flowers 1–2. Perianth 1½–2 in. long, white, spotted inside, especially

towards the edge of the segments, with small dots of red-brown; segments obtuse, ¼ in. broad, oblanceolate, reflexing from a short basal cup. Filaments arcuate, about an inch long; anthers linear, ½ in. long. Style nearly as long as the perianth.

Eastern Kansu and Eastern Tibet, collected by Père David, in June 1869, and M. Potanin; Western China, in Szechuen, on the mountains round Ta-tsien-lou by Prince Henry of Orleans, and Yunnan in the wood of Kou-toui by Delavay. Differs from *L. polyphyllum* by its shorter flowers and wide-creeping, slender rootstock and broad bulb-scales.

L. lankongense, Franch. in *Journ. de Bot.* vi. (1892) 317. Stem slender, pubescent, 1–2 ft. long, leafy almost from the base. Leaves moderately dense, ascending, scattered, lanceolate, 5-nerved, the largest 2½ in. long, ¼ in. broad, scarcely scabrous on the ribs and edges. Flowers 1–3, cernuous, long-peduncled. Perianth 1½ in. long, reflexing from low down, white or purple, spotted with black; segments oblanceolate; nectary papillose. Filaments much shorter than the perianth; anthers yellow. Style 2–3 times the length of the ovary.

Western China; Yunnan, Lankong, and other localities, reaching a height of 8,000–9,000 ft. Collected by Delavay in 1888. Nearly allied to *L. polyphyllum*.

L. papilliferum, Franch. in *Journ. de Bot.* vi. (1892) 316. Bulb small, subglobose; scales 10–12, thick, ovate. Stem slender, a foot long, leafless on the lower part, clothed with short papillose pubescence. Leaves moderately dense, ascending, the lower oblong, obtuse, the upper lanceolate or linear, the largest 2 in. long, ¼ in. broad, 5-nerved, scabrous on the ribs and margins. Flowers 1–2, cernuous. Perianth campanulate, reflexing from below the middle, 1½–2 in. long, bright red. Filaments much shorter than the perianth; anther yellow, linear, ¼–⅓ in. long. Pistil as long as the stamens. Capsule obovoid-oblong, 1½ in. long. *L. Biondii*, Baroni in *Nuov. Giorn. Bot. Ital.*, n.s., ii. 337, t. 8, 9.

Western China; province of Yunnan, rocky ground above Tapin-tze; alt. 5,000–6,000 ft., Delavay, collected in 1888. It has been introduced alive into Italy under the name of *L. Biondii*. It is allied to the Japanese *L. Maximowiczii*.

L. Rosthernii, Diels in *Engl. Bot. Jahrb.* xxix. 243. Stems slender, subglabrous, 1–1½ ft. long. Leaves scattered, linear-oblong, sessile, the central ones largest, 3–4 in. long, ⅓ in. broad, with revolute edges; midrib prominent, the other veins inconspicuous. Flowers one or few; bract leaves broadly ovate. Perianth probably yellow, about 2 in. long; segments lanceolate, ½ in. broad, reflexing from low down, crisped, copiously dotted on the face; nectary glabrous; papillæ long. Stamens and style as long as the perianth.

Western China; province of Szechuen, south of the Yang-tze-kiang, at Kuebow, Kenaping, Nanchuan, *Rosthern*, 660. Must be near *L. papilliferum*, Franch.

L. Fargesii, Franch. in *Journ. de Bot.* vi. (1892) 317. Bulb small, ovoid; scales 10–15, ovate-acuminate. Stem slender, a foot or more long, thinly scabrid, pubescent, leafless towards the base. Leaves linear, ascending, laxly disposed, the largest reaching a length of 6–7 in., ⅛–¼ in. broad, narrowly revolute at the edge. Flowers 1–10, on long

peduncles subtended by long leaves, at first cernuous, then horizontal or suberect. Perianth 1½-2 in. long, reflexing from low down, yellow, with copious small purplish spots inside; segments lanceolate, ¼ in. broad, with several fimbriated crests towards the base. Stamens half as long as the perianth; anthers small; pollen yellow. Style but little longer than the ovary. Capsule oblong, under an inch long.

Western China; province of Szechuen, near Tchen-kiou-tin. Collected by Father Farges. Nearly allied to *L. tenuifolium* and *L. Davidi*.

L. sutchuenense, Franch. in *Journ. de Bot.* vi. (1892) 318; Hook. fil. in *Bot. Mag.* t. 7715; *L. chinense*, Baroni in *Nuov. Giorn. Bot. Ital.* 1895, 333; 1894, 304. Bulb globose, 1½ in. diameter; scales ovate. Stem slender, 2-3 ft. long, scabrous, leafless towards the base. Leaves moderately dense towards the base, ascending, linear, the largest 4-6 in. long, ⅛-⅙ in. broad. Flowers 1-4, on long spreading peduncles subtended at the base by small leaves, horizontal when expanded. Perianth bright scarlet, 2 in. long, copiously spotted inside with dark brown; segments spreading from below the middle, oblong-lanceolate, ½-⅝ in. broad; nectary papillose. Stamens much shorter than the perianth; anthers linear, ¼-⅓ in. long; pollen dark yellow. Style 3-4 times the length of the clavate ovary.

Western China; province of Szechuen. Collected both by Prince Henry of Orleans and Father Farges. The *Bot. Mag.* figure was drawn from plants flowered at Kew in 1899, the bulbs of which came from M. Vilmorin. Allied to *L. Maximowiczii* and *L. Pseudo-tigrinum*.

Section MARTAGON: American.

L. nitidum, Hort. Bull; Baker in *Gard. Chron.* 1880, xiv. 198. Bulb transversely oblong; scales crowded, lanceolate adpressed, 1½ in. long. Stem 1½ ft. long below the inflorescence, stout, terete, glabrous, purple in the lower part, green upwards, bearing four whorls of leaves and a few scattered ones above them. Leaves up to twenty in a whorl, lanceolate, bright green, glabrous, 1½-2 in. long, under ½ in. broad at the middle. Inflorescence deltoid, made up of 10-20 flowers; lower pedicels 2-3 in. long, cernuous at the top. Perianth bright yellow, 1½ in. long; segments lanceolate, under ½ in. broad, revolute in the upper half, with copious small red-brown dots. Filaments above an inch long; anthers bright yellow, ½ in. long. Pistil an inch long.

California, introduced by Mr. Bull in 1880.

L. Kelloggii, Purdy in *Garden*, 1901, i. 331, fig. 330. Bulb like that of *L. columbianum*, small, with lanceolate, closely adpressed scales. Stem slender, 3-5 ft. long, tinged purplish-brown. Leaves in several whorls, oblanceolate, acute, sessile, 2-3 in. long. Flowers 1-8, racemose or umbellate. Perianth 1½-2 in. long; segments oblanceolate, reflexing from low down, pinkish purple, finely dotted with maroon. Stamens shorter than the perianth; anthers brownish yellow. Style a little longer than the stamens. Ripe capsule oblong-cylindrical, 1¼-2 in. long.

California; Humboldt county, in the redwood region. Discovered by H. N. Bolander. Habit of *L. rubescens* as regards bulb, leaf, and general appearance, but segments as much reflexed as in *pardalinum*. Flower different from that of *rubescens* in colour, and capsule different.

L. Grayii, S. Wats. in *Proc. Amer. Acad.* xiv. 256, 302; *Garden and Forest*, vol. i. pp. 19, 56, 256, fig. 4; *Man. Bot. North Unit. States*, edit. vi. 529; Baker in *Bot. Mag.* t. 7234. Bulb small, globose, annual, arising from a wide-creeping rootstock: scales small, thick, ovate. Stem slender, erect, glabrous, green, 2–3 ft. long. Leaves typically in about four whorls of 4–8 leaves each, sessile, oblanceolate, bright green, 2–3 in. long, spreading horizontally. Flowers 1–3, long-peduncled, horizontal or cernuous, red or tinged with yellow towards the base, especially inside. Perianth funnel-shaped, 2–3 in. long; segments oblanceolate, spotted more or less copiously with claret-red, spreading very little when fully expanded. Stamens a little shorter than the perianth; anthers linear-oblong, $\frac{1}{6}$ in. long. Pistil as long as the stamens. (Fig. 179.)

Alleghanies of Virginia and North Carolina. First collected by Dr. Asa Gray in 1840. Nearly allied to *L. canadense*.

L. Bolanderi, S. Wats. in *Proc. Amer. Acad.* xx. 1885, 377; *Garden*, October 25, 1890, coloured figure. Bulb globose, 1 $1\frac{1}{2}$ in. diameter; scales ovate, very acute. Stem slender, 1–3 ft. long. Leaves mainly in four whorls, the lower of 12–15 leaves, sessile, horizontal, oblanceolate, 2 in. long, $\frac{1}{2}$ in. broad. Flowers 1–3, horizontal or rather drooping, dull red, copiously spotted inside. Perianth funnel-shaped, $1\frac{1}{4}$–$1\frac{1}{2}$ in. long, the oblanceolate segments $\frac{1}{3}$ in. broad, hardly reflexing at all. Stamens a little shorter than the perianth; anthers oblong, $\frac{1}{4}$ in. long. Pistil as long as the stamens.

California; Humboldt county. First collected by Bolander in 1867. Allied to *L. parvum* and *L. maritimum*. Described from specimens sent by Mr. T. Ware in July 1890.

L. occidentale, Purdy in *Erythræa* v. 1897, 103. Bulb shortly rhizomatous, as in *L. pardalinum*. Stem 2–6 ft. long, dark green. Leaves forming whorls in the middle of the stem (5–12 or more leaves in each), oblanceolate, acute, 2–4 in. long, 3–4 lines broad, bright green. Flowers from few to 15, racemose or umbellate; peduncles 3–9 in. long, cernuous at the apex. Perianth $1\frac{1}{2}$–$2\frac{1}{2}$ in. long; segments 4–6 lines broad, crimson towards the tip, orange-red with copious black spots lower down, the outer soon becoming revolute, the inner tardily so for some days, spreading broadly. Stamens a little longer than the style; anthers oblong, dark red.

California, from Humboldt Bay to above Arcata, taking the place filled by *L. maritimum*, to which it is closely allied, further south.

L. parvum, var. *luteum.*, Purdy in *Erythræa*, v. (1897) 105. Bulb as in the type, rhizomatous, not forming clumps; scales often 3-jointed. Leaves mostly scattered, but some in whorls at the middle of the stem, obovate-lanceolate, light green. Stem few-flowered or many-flowered. Segments of perianth revolute from the base, a clear, brilliant, reddish-orange throughout, not tipped with red, spotted with small bright red spots.

California; Plumas county. Collected by Mrs. Austin.

L. Bakeri, Purdy in *Erythræa*, v. (1897) 104. Bulb ovoid, exactly like that of *L. canadense*, 5 inches in circumference. Stem 2–6 ft. long, rather stout, terete. Leaves mostly whorled, lanceolate, bright green. Flowers 4–10, strictly racemose; lower peduncles 4–5 in. long, upper $1\frac{1}{2}$–2 in.; buds nodding; open flowers horizontal. Perianth $1\frac{1}{4}$ in. long; segments

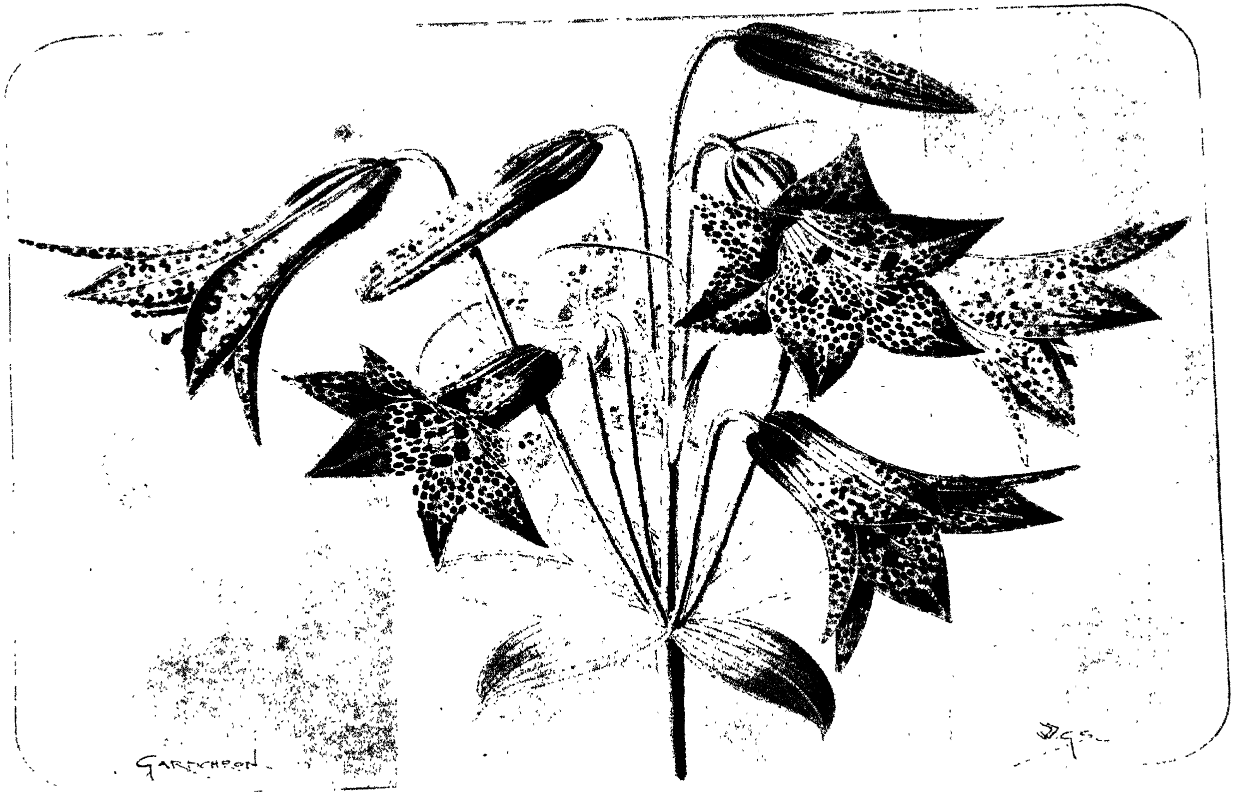
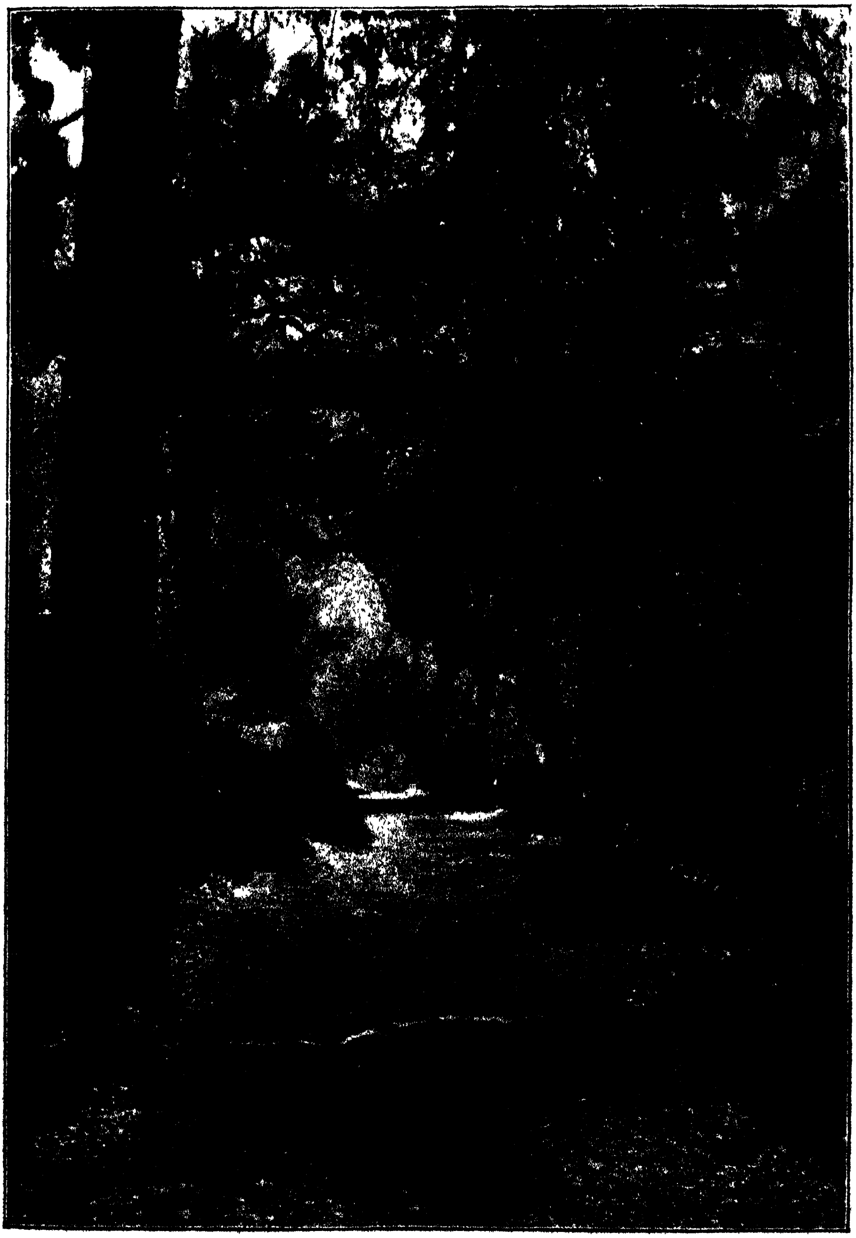


FIG. 179.—LILIUM GRAYII. (*Gardeners' Chronicle.*)

(*To face page* 344.)

five lines broad, acute, orange-red, thickly spotted with maroon dots in the lower part, spreading widely in the upper half. Stamens rather shorter than the perianth, spreading widely. Pistil a little shorter than the stamens.

Sandy woods along Puget Sound in Washington Territory and Southern British Columbia. Very fragrant. Nearly allied to *L. columbianum*, Hanson (*L. lucidum*, Kellogg). Its bulb at the largest is 5 inches in circumference, and weighs 2 ounces.



NOTES ON CHINESE LILIES.

By Dr. Augustine Henry.

I purpose in the following notes to give some slight account of the habitat of the Lilies which I met with while collecting in China. The number of species seen by me was not very great. Most of the new Lilies described by Franchet were collected by the French missionaries in regions further west than I penetrated; and it is evident that the high mountainous regions of Western Yunnan and Szechwan are richer in species than parts to the eastward.

My first collecting-ground was in Central China, in the vicinity of Ichang, at the eastern end of the Yangtse gorges, and I will speak first of the Lilies observed in this locality. Ichang, though 1,000 miles inland from Shanghai, is only seventy feet above sea-level; and in the low hills close to the town, amidst the grass, *Lilium callosum*, S. et Z., grows, but is not very common. This Lily was first discovered in Japan, where the flowers are said to be brilliant scarlet. The colour of the Ichang plant is, however, so far as my notes and my memory are to be depended on, a brilliant orange. In the Kew Herbarium, my specimens, Nos. 511 and 2,327, belong to this species.

Branching off from the gorges of the Yangtse there are many beautiful glens, walled in by high cliffs, and in these *Lilium Brownii*, Miellez, is common. It grows in rocky places, in shelter but not in shade. It is very variable in foliage and in the colour of the flowers. I sent some bulbs to Kew from Ichang which turned out to be a new variety, *Lilium leucanthum*, characterised by bulbils in the axils of the leaves and by short ovate leaves below the flowers. The colour of this variety is never so yellow in the wild state as it seems to become when cultivated in England. In the south-east of Yunnan, *Lilium leucanthum* is the form which is most common; and it occurs there in similar rocky situations, but at an elevation of 1,000 to 5,000 feet above sea-level. This part of Yunnan is ten degrees south of Ichang.

Lilium tigrinum, Ker, was cultivated by the peasants in their gardens near Ichang, but I never saw this Lily wild in any part of China I have been in.

Lilium Henryi, Baker, was found by me in only two localities, both near the town of Ichang, and has apparently a restricted distribution. In my journeyings through the high mountains to the north, south, and west of Ichang, I never met with this Lily. It grows on the grassy slopes of precipices, at a height of 200 to 2,000 feet above sea-level on the sides of the Yangtse gorges, and of some of the glens, but it is not met with in the bottom of the glens—only on their precipitous walls, and on the tops of cliffs. A few plants were seen by me on the Dome, a mountain mass of conglomerate some ten miles south of Ichang. The precipices of the Yangtse gorges where the Lily grows are of limestone. The plant would seem then to be, in the wild state, indifferent as to soil.

This Lily grows in exposed situations and not in shelter, thus differing markedly from *Lilium Brownii.* In the wild plants, the flowers are orange with black marks, which are elevated, in the interior of the perianth near the base. Other orange projections occur, which I likened to little horns. In the wild state I never saw plants of any great size, never higher than 4 feet, and generally 1 to 4 or 5-flowered. (Fig. 180.)

FIG. 180.—L. HENRYI.

Inland from the Yangtse gorges, north and south, the country is an immense mountain mass, cut up by deep ravines, and rising in chains to from 6,000 to 10,000 feet above sea-level. In these mountains, at 5,000 to 7,000 feet, on the cliffs, there occurs a small Lily, which is represented at Kew by my numbers 5,917 and 6,786. I found these specimens

identified in the herbarium as *Lilium tenuifolium*, Fisch, but I am of opinion that they are *Lilium Fargesii*, Franchet, a Lily discovered by Père Farges in the mountains of Szechwan, westward from where I found the Lily north of Ichang. My specimens had greenish-white flowers, with numerous mauve dots on the interior of the perianth, and Franchet describes his species as yellow, marked on the inside with numerous purple spots. My specimens resemble exactly a drawing of *Lilium Fargesii* in the Kew Herbarium. My plant is quite different from *tenuifolium*, which has crimson flowers.

Lilium giganteum, Wall., only occurs in high mountain forests both in Hupeh and Yunnan. It differs from other Lilies in its habitat, as it is never seen in open grassy places, or in ravines. It is a characteristic

FIG. 181.—L. GIGANTEUM.

plant of mountain forests. The flowers vary considerably in colour. The perianth is often pure white, with the exception of a narrow band of red on the outer edge of the segments, interiorly and exteriorly. Generally, of the six segments, four would show red bands, the other two being pure white. In a variety noticed by me in Hupeh, the flowers are almost green, with some reddish-brown on the interior of the perianth. (Fig. 181.)

In Formosa my collector brought me *Lilium longiflorum*, Thunb., from the South Cape, but I had no opportunity myself of seeing this plant growing wild. It occurs at Tamsui, at the northern end of the island, and is also recorded from the Loochoo Islands. Apes' Hill, a mountain close to Tchow, on the west of the island, rising to about 1,100 feet, was thoroughly botanised by me, but I never saw any Lily there.

Recently I have been stationed in the south of the province of

Yunnan, at two points: Mengtse, close to the Tonkin frontier, and Szemao, to the north of the British Shan States and Burmah. Both these regions and indeed all Yunnan are extremely mountainous, and I collected at elevations of from 1,000 feet to 10,000 feet above sea-level. In the high mountains near Mengtse *Lilium giganteum* occurs in the forests, as I have already mentioned. *Lilium leucanthum* is common near Mengtse in glens, in rocky places more or less sheltered. It has larger flowers than the Ichang plant, and the bulbils and greenish tint of the flowers make it look very different from *Lilium Brownii*.

On the bare grassy mountains near Mengtse, at elevations of 5,000 to 7,000 feet above the sea, a Lily is very common, occurring in great quantities. This Lily is from 1 to 3 feet in height, and the flowers are pink or purple-pink, with much speckling of a browner tint in the lower half of the perianth interiorly. This is represented at Kew by my number 10,774, and has been identified as *Lilium Lowii*, Baker, which was found in the British Shan States much further south, and was described as

FIG. 182. - L. NEPALENSE.

being a white Lily with claret markings. The Mengtse Lily is never white. Its leaves are very variable, but are generally narrow and coriaceous, and very numerous. This Lily only occurs in exposed situations on the mountains amidst the grass.

Closely resembling the preceding Lily is my No. 10,774 B, which has also pink flowers. This has been identified at Kew as *Lilium Pseudo-tigrinum*, Carr. It was collected by me on grassy mountains, south of Mengtse, at 6,000 feet elevation.

My No. 10,743 is a much smaller Lily, with pinkish-purple flowers, occurring in similar situations in the mountains near Mengtse. It has been identified at Kew as *Lilium yunnanense*, Franchet. Whether these last three Lilies are mere varieties of one species is worth considering.

Near Szemao I found a Lily at about 6,000 feet elevation, my No. 13,026, with white flowers and reddish markings. It has been identified as *Lilium Bakerianum*, Collett & Hemsley. It differs from the last Lily not only in the colour of the flowers, but in the leaves, which are much fewer on the stem, larger, wider, and not coriaceous. This Lily occurs in grassy exposed mountain spots.

Lilium nepalense, D. Don, is very common at Mengtse, not only in the rocky ravines, but also on the open grassy mountains, at elevations of 5,000 to 9,000 feet. It varies remarkably in size and colouring of the flower. The general groundwork of the colour is yellow, but the yellow may be very light or very deep in tint. The markings are also most variable, from purple to a dark plum-colour, and are also variable in extent. Bulbs of this Mengtse Lily sent to England have produced flowers which are similarly variable, almost looking as if they were new species. (Fig. 182.)

These are all the Lilies which I have observed, and, as I have tried to show, they vary a great deal in their habitat, some being Lilies of rocky sheltered glens, others occurring on the open grassy parts of the mountains, while *L. giganteum* is only to be seen in the depths of the high mountain forests.

THE LILIES OF THE WESTERN UNITED STATES AND BRITISH COLUMBIA.

By Carl Purdy, U.S.A.

Thirteen clearly distinct species of Lilies have been found in the region indicated by my title and lying west of the Rocky Mountains.

Along the coast of California and Oregon there is a broad mountainous belt, from fifty to eighty miles wide, called collectively the Coast Range.

With its plateaus facing the ocean, its valleys and vales, its low hilly regions, and great mountains rising to six thousand feet altitude, with forested areas of varied character throughout its extent, and hundreds of climates, it is a great and wonderfully diversified region.

Parallel with the Coast Range, separated from it by the broad valleys of California and Oregon, and by the sound farther north, connected to it by several great cross ranges greatly exceeding it in altitude, differing greatly in soils and far less humid, is another great system called in Southern California the Cuyamaca and San Bernardino Mountains, in Central and Northern California the Sierra Nevadas, and in Oregon and Washington the Cascades, and which collectively can be called the Sierra Nevada mountain system, and, under whatever name, forming part of the great barrier between the fertile Pacific slope and the arid regions of the great central plateau.

To these two great mountain systems nine of our Lilies are confined. *Lilium columbianum* continues east over the upper Columbia River basin, *L. Parryi* is found also in the high mountains of Arizona, and *L. Roezlii* and *L. pardalinum* are doubtfully reported, the one from Utah in the Great Basin, the other from the shores of Lake Winnipeg, far east of the Rocky Mountains.

To the Sierra Nevada system of California six species belong, three of them peculiar to it. To the Coast range of California, from San Francisco Bay north, a length of 250 miles, seven of our thirteen species are native, five its exclusive property. Oregon has four species, only one peculiar to it, while north of the Columbia River only *L. pardalinum* and *L. columbianum* extend into British Columbia.

From the Sierra Nevada system east to the Rocky Mountains lies a vast region, treeless in its lower levels, desert or arid in its middle and southerly extent. Out of these arid lower levels great mountains rise here and there, the islands of an ancient sea. This great arid break separates the Lilies of the Pacific slope from their Atlantic cousins, and in it no Lilies have been found.

The thirteen Pacific coast species can be divided by their affinities into three groups.

In the first we should find *L. columbianum* and *L. Humboldtii*,

dry-land Lilies, with ovate bulbs, and orange-spotted flowers of Baker's Martagon group.

The second would include all of our orange and yellow Lilies having rhizomatous roots, and natives of moist or boggy soils—viz.: *L. Roezlii*, *L. pardalinum*, *L. parviflorum*, *L. parvum*, *L. occidentale*, *L. maritimum*, and *L. Parryii*, falling under Baker's Martagon and Eulirion groups, but some of them doubtfully.

The third group would be of dry-land Lilies, with ovate bulbs, and white, pink, or purplish flowers, and would include *L. Washingtonianum*, *L. rubescens*, and *L. Kelloggii*, the first two falling in Baker's Eulirion group, the latter, by its revolute perianth, being classed with the Martagons.

This would leave *L. Bolanderii* unclassified.

These three groups form a closely interlacing chain with several loops, and only a few links are needed to make the connections perfect.

L. columbianum is a miniature *L. Humboldtii*.

L. Humboldtii var. *Bloomerianum*, at the extreme south, has bulbs composed of several jointed scales, and much crimson colour on the perianth, bringing it close to *L. pardalinum*.

L. Roezlii and *L. pardalinum* are closely connected, while *L. parviflorum* on one side connects *L. pardalinum* to *L. parvum*, while in another direction *L. occidentale* is as perfect a link to *L. maritimum*, and in still another *L. pardalinum* var. *Wareii* is a perfect link with *L. Parryii*.

L. Parryii and *L. Washingtonianum* have affinities in fragrance and shape of flower, but otherwise there is quite a gap to be filled between *L. Washingtonianum* and the last group. The three species of the last group have marked affinities in many ways.

The thirteenth unassigned species has a bulb and foliage strongly suggestive of the Washingtonianum group. Its cup-shaped flower suggests *L. elegans*, while its deep red colour, spotted with maroon in the throat, are suggestive of *L. maritimum*.

So far for what we know. What prospect, it may be asked, is there for new Lilies in the territory I have described? I may answer by stating that in one county, by no means difficult of access, I discovered *L. Kelloggii* and *L. occidentale*. In one township I found two Lilies, either of which might well be made a species and forming links between other species.

While there are no great areas which some botanist has not visited, yet practically there is a great unexplored region.

Very few botanists are conversant enough with known species to recognise the links we seek. The specialist still has much to do, and I confidently predict that our coast will yet add (to our already large contribution to the garden) some very distinct species and very many beautiful variations, and that our known species will yet be perfectly linked.

For full descriptions of the Lilies hereinbefore mentioned I refer to Baker's Tulipeæ and Wallace's Notes on Lilies, except for the newer species.

1. *L. Humboldtii.*—From Fresno County to Tehama County, in the

Sierra Nevada Mountains of Central and Northern California, the typical *L. Humboldtii* is to be found. It is very stout and leafy, 4 to 8 feet high, many-flowered, a rich orange throughout, spotted with maroon. The bulbs are large and solid when mature, 7 inches to 20 inches in diameter, and weighing from six ounces to a couple of pounds. *The scales are never* jointed. Except at one point they are to be found in the lower Yellow Pine belt (*P. ponderosa*) at 1,400 to 3,500 feet altitude, growing in open woods among low undergrowth, in a more or less rocky red clayey or volcanic soil, perfectly drained, and not at all rich in mould. The finest wild specimen I ever saw, however, was where a mass of *débris* had filled a space close to the side of a mountain stream. (Fig. 183.)

At one point in the Sacramento Valley, miles from the nearest hill, *L. Humboldtii* is scattered for miles along the river in the oak woods, which form a broad timbered fringe. The soil there is from a heavy loam to a sticky black clay.

In cultivation I find that under the most favourable conditions the

FIG. 183. –L. HUMBOLDTII.

typical *L. Humboldtii* seldom flowers the first year. A 10 per cent. bloom from large bulbs would be a good showing.

I grow it perfectly at my Lyons Valley Lily garden in all soils except a damp soil, rich in mould. There it rots. At the Stanford University Palo Alto, California, it was planted in adobe, a black sticky clay, and the most trying of soils for most Lilies, and it thrived admirably.

My recommendation for its culture would be to give perfect drainage, even if rubbled underneath; let the soil be of moderate strength, sandy, or loamy, but made porous with charcoal or grit, and, lastly, the friendly shelter of low-growing shrubs or perennials, also rather deep planting, say 8 or 10 inches.

1*a*. *L. Humboldtii* var. *magnificum* is the form in the San Bernardino Mountains of Southern California and along the coast as far north as Santa Barbara; also on the islands off the coast. In size it is the equal of the type, the foliage is darker, and the stem dark. The flowers are orange, spotted with maroon, each spot oculated with crimson. The bulb becomes a rich purple after a short exposure. The scales are more

pointed, and some on every bulb *are two or three jointed*, with easily separable joints.

It is found at rather low altitudes in the cañons of the mountains of the region described. It is an arid region, and the bulbs are seldom over a couple of hundred yards from the edge of the mountain streams on the cool slopes. They grow in a granitic sand and *débris*, of course with the mixture of leaf mould which such a habitat would ensure.

As a garden plant it is far the superior of the type. Equalling it at its best in size and as showy, it is a far better grower, takes kindly to most soils, roots well, and 90 per cent. flower the first year. Having strong roots above the bulb, it is also a surface feeder. Even bulbs as small as 5 inches in diameter flower well.

1*b*. *L. Humboldtii* var. *Bloomerianum*, or *L. Bloomerianum*. This variety is a native of the high mountains of San Diego County, and is the southernmost representative of the species. Compared to the two foregoing it is a dwarf. Seldom over 4 feet in height it has a bulb little larger than that of *L. columbianum*, often not over an ounce in weight, and more jointed than in the last. Its colour scheme is similar, but neither in foliage nor colour is it nearly so pretty. Like *L. Humboldtii* var. *magnificum* it is a sure bloomer, and usually flowers the first season after moving.

L. Humboldtii var. *occellatum*, as described by Baker, would include these two variations.

2. *L. columbianum*.—This pretty little Lily, the miniature of *L. Humboldtii*, is found throughout the North-west, in Oregon, Washington, and British Columbia. It grows oftener among the brakes in moist, well-drained soil. It varies little.

I have found it an easy Lily to grow. A good loam, drainage, and shelter, comprise its needs.

3. *L. Roezlii*.—This pretty rhizomatous Lily was originally described as from Utah, whence it has not since been reported. I have it from Southern Oregon. Its closely revolute flower, orange, dotted with maroon, very slender crowded leaves, few of them in whorls, and solitary rhizomatous roots, with three or four jointed scales, are its distinguishing points. It seems to be a true bog Lily. My collectors so report it, and the muck its bulbs bring with them supports the belief well.

At Lyons Valley it succeeds admirably in the always moist, almost pure leaf mould about my spring, but is nearly as good in a deep, loose, gritty soil, so dry as to need irrigation in June.

The English grower should give it a place in the Rhododendron bed, or brook, or pond margin.

4. *L. pardalinum*.—This is a species that needs no introduction. We have it in both great belts from Lower California on one side to British Columbia on the other. Var. *Bourgæa* has been accredited to Lake Winnipeg, far east of the Rocky Mountains. (Fig. 184.)

L. pardalinum is not reported from any point east of the Cascades, and I very much doubt its being represented at so distant a point by a variety.

In the region in which I know it, it is the most variable of Lilies. It is scarcely alike in two places, and in the distribution of its varieties

Fig. 184.—Lilium pardalinum var. californicum. (*Gardeners' Chronicle.*)

I can see no governing law, no gradual transition from one form to another. With over twenty years' observation and every facility, I cannot say that I can identify any one of the wild variations I know with the named varieties of the books and gardens, and I shall not now enter into such a hopeless task, and so add to a confusion of varieties. Luther Burbank took up a form and differentiated it wonderfully, and these seedlings have been widely distributed, as well as a large number of his hybrids, in which the *pardalinum* blood is dominant. The rational thing to do now is to drop all botanical names for its varieties and to select the best for propagation under convenient horticultural names.

One variation, *L. pardalinum* var. *Wareii*, I cannot, however, pass unnoticed. It is a clear yellow, unspotted, fragrant form of the species, and clearly a transitional form between *L. pardalinum* and *L. Parryii*. The "Garden" published a beautiful plate of it some years ago.

Its history is an interesting one. It was sent to England years ago as an ordinary *L. pardalinum*, but it has never since been found in California. The most reliable information would make it a native of the extreme south of California. In that region *L. Parryii* is known as well as a fragrant form of *L. pardalinum*, but so far var. *Wareii* is a lost Lily.

There seems to be a misconception generally as to the habitat of *L. pardalinum*, the idea being that it is a *bog* Lily. This is by no means the case. Moisture it loves, and it sometimes grows in very wet places, but in bogs never, and the finest developed plants are not in wet places.

Go with me in the Coast Range mountains to where high in their bosom some living stream has formed a little vale deep with sandy loam and wash from the surrounding slopes, and there overtopping the tall grasses and weeds which are stimulated to a luxurious growth I will show you this beautiful Lily higher than a man and glorious in its orange and red bloom, its bulb in a sharp well-drained soil, its roots running down to abundant moisture. In such spots it grew by acres before civilisation with its plough and hog came. I have often seen masses containing 200 to 300 bulbs solidly matted together. If it is on the bank of the stream in deep sandy loam, where the roots can run down to water, it is still happier. It glories in air and sunshine, and where the stream banks are shaded never equals its stature in more exposed places. In cultivation, land that will grow good Potatos will suit it.

Luther Burbank grew it to perfection by thousands, grown as Potatos would be at his Sebastopol place, in land perfectly adapted to deciduous fruits of all sorts, and my experience is that any good loam, well drained and cultivated, with very moderate watering, suits it. The largest plants I ever saw were grown in a Pæony bed in my Ukiah garden in a stiff clay loam.

5. *L. parviflorum*.—A native of the Sierra Nevada Mountains of Northern and Central California, in the same region as the typical *L. Humboldtii*, i.e. 1,500 to 3,500 feet elevation, growing in sandy alluvium on the banks of living streams or among brush and weeds in alluvial flats. There are many pretty variations in colour.

L. parviflorum has the bulb, foliage, and capsule of *L. parvum*, and the revolute flower of *L. pardalinum*. The rhizomes seldom branch, and it therefore never forms masses as that species does. It is paler in

foliage and smaller and earlier-flowered. Altogether a good plant, of fair constitution, but not as vigorous as *L. pardalinum.* A good loam and moderate moisture in a sheltered position are to its liking.

6. *L. parvum.*—A pretty Lily, parallelling the Eastern *L. canadense*, found only from 5,000 feet to the sub-alpine regions of the Sierra Nevadas of California, in the Lake Tahoe section. In the sub-alpine regions I have seen it in coves among the alders and *Pinus Murrayana*, in a soil of granitic sand and leaf mould, on the margins of lakes and on the banks of cold streams. In the higher altitudes it is a foot or two high, while in the deeper soil along streams, growing among the alpine willows and *Aconitum*, it may be five to six feet high and many-flowered. The leaves are ovate lanceolate, a light pleasing green, with few perfect whorls, the flowers broad funnel form, with recurving tips a rich orange at centre, with red tops finely dotted.

It will be noted that it is never a bog Lily, but like *L. pardalinum* and *L. Parryii* happiest in a sharp soil where it can reach abundant water while the bulb is in perfectly drained soil.

At Lyons Valley it thrives admirably in a loose, well-drained soil under a big alder, always moist, never wet.

7. *L. maritimum.*—This species is found in the maritime parts from Mendocino to San Francisco Counties, North-western California, a region of abundant winter rains, brisk winds, and frequent summer fogs. Seldom growing over three miles from the ocean, it can be found in a dwarfed form in the dry sandy barrens, growing finely among the brakes on the forest border in a soil of sand rich with mould, and still better in peat bogs. There on some hummock rising a foot or so above the bog level, growing in an almost solid mass of roots of *Ledum* or *Vaccinium*, it reaches a height of five or six feet, with a dozen or more flowers.

The rhizomatous bulbs never branch to form clumps. I find a well-drained, cool soil, always moist, suits it well. The Rhododendron bed should suit it exactly, but, as with our other Lilies, it will do best where, with a peaty soil, the drainage is good and the moisture is *under* rather than *about* the bulb. I do not know of a Pacific coast Lily that I would dare to plant in a mucky, saturated soil.

8. *L. occidentale.*—Another rhizomatous rooted Lily, which is native to Humboldt County, North-western California, under exactly the same conditions in which *L. maritimum* grows, and subject to the same remarks.

L. occidentale, at its best, is five or six feet high, with dark green foliage, mostly in whorls, and a dozen or so revolute flowers, varying from a medium to a dark glowing crimson, maroon spotted in the throat; a very brilliant Lily indeed. The bulb is exactly that of *L. maritimum*, of large, few jointed scales, and never forming clumps. It might be described as a *L. maritimum* with revolute flowers.

9. *L. Parryii.*—A noble Lily, native to the high mountains of Southern California and of Arizona, where, at 6,000 to 10,000 feet altitude, it grows under exactly such conditions as *L. parvum* is found in farther north. At the higher altitude it is a dwarfed plant a foot or two high, and one or two flowered with a small bulb. There it is in granitic sand mixed with leaf mould in moist flats or along the cold

streams. Lower down it is confined to larger stream banks or rich moist flats. It is at its best where the stream has thrown a deep alluvial deposit of sand, silt, grit, leaves, and charcoal, where it develops into a noble plant five or six feet high and many-flowered. It is never a *bog Lily*, and to so treat it is to court failure. The Rhododendron bed, or some such treatment as was given by a recent writer in the "Garden," is doubtless best with you. I should advise two to three parts of sand, one to three parts of peat or leaf mould, with a liberal addition of grit and charcoal, a sheltered place, good drainage, but *moisture* would be the thing. It is figured and described as lemon-yellow, dotted in the throat with maroon. Many of my plants are destitute of dots and are all but orange. (Fig. 185.)

10*a*. *L. Washingtonianum.* From San Diego County, in Southern California, to Mt. Shasta, on the north, at an elevation of from 4,000 to 8,000 feet, the Californian form of this Lily is to be found, sometimes in open pine forests, but usually growing in a thick undergrowth of *Arctostaphylos*, *Ceanothus*, Wild Cherry, and other shrubs in a deep, sandy, perfectly drained soil. In the fall a heavy coat of snow covers their home, which, melting in late spring, keeps the ground saturated for a season. The Lilies come up through and bloom above the brush in July or August, according to altitude and conditions. After a fire clears the underbrush, leaving only charred branches, they are at their best.

The bulb of this form is long and narrow, and rather loose, of long scales, *never jointed*. Mature bulbs are seven to fifteen inches in circumference and six to sixteen ounces in weight, but I have seen them as much as twenty-eight inches and four pounds. (Fig. 202.)

They are very liable to decay when dug, no matter how carefully or how thoroughly ripe the bulb.

The leaves are few, in whorls, and the whorls far apart. In shape lanceolate and very undulate, five to eight to the whorl. The flower is pure-white, often finely dotted in the throat with purple, broadly funnel form with the upper $\frac{1}{3}$ spreading or somewhat running. The segments are so narrow that there is a space of fully half their width between them in the tube.

10*b*. *L. Washingtonianum*, var. *minor*.—Around the base of Mt. Shasta there is a peculiar and interesting form of *L. Washingtonianum* which bears the same relationship to the species as var. *Bloomerianum* does to *L. Humboldtii*. In this variety, which I have named *minor*, the bulb is ovate and compact, seldom over five inches circumference and oftener less, and an ounce or two in weight. The stem is slender, the leaves five to eight in a whorl and the whorls far apart, leaves lanceolate in shape, rather narrow, and strongly undulate. Above and below the few whorls the leaves are narrower and scattering. The general impression given by both this and the Sierra form is of very scant foliage and rather naked stem, and in both there is a considerable amount of purple colouring on leaf, petiole, and stem.

As in the Sierra species the segments of the perianth form a broadly funnel-shaped tube $\frac{2}{3}$ of their length, with the upper $\frac{1}{3}$ broadly spreading and slightly recurved, and are rather of the *longiflorum* than of the *candidum* form. The segments are oftener pure-white, a trifle fuller in

FIG. 185.—LILIUM PARRYII. (*Gardeners' Chronicle.*)

(*To face page* 358.)

proportion than the Sierra form, yet still so narrow that there are spaces between them the entire length of the tube.

These Californian forms are very beautiful Lilies. The small bulbs of var. *minor* are quite as floriferous as the large ones of the type.

FIG. 186.—LILIUM WASHINGTONIANUM VAR. PURPUREUM. (*Gardeners' Chronicle.*)

10*c*. *L. purpureum*, n. sp.—From the Siskiyou Mountains on the northern border of California northward in Oregon to the Columbia River, in the Cascade range, and throughout the hilly or mountainous wooded region of South-western Oregon to the Pacific, and not only at high altitudes, but as low as 600 feet, and at various places in the open

valleys and half-wooded uplands. A form (heretofore considered *L. Washingtonianum*) is found so strongly marked as to justify a new species, in my opinion. (Fig. 186.)

The bulb is large, when fully developed as large as the variety which comes from the Sierra Nevada, but solider and heavier.

The bulb scales are frequently two or three jointed, with easily separable joints, the stem stout and very leafy, the leaves broadly obovate, 3 or 4 inches long by 1½ wide, mostly in whorls of 10 to 14, the flowers often in a terminal umbel, but if many racemose.

In outline the flowers are almost like *L. candidum*, having a very broad funnel-form tube one-half of their length, from which they broadly spread and finally recurve. The inner segments are one to three times as long as they are wide.

In this form the flowers open white, dotted with purple. In some localities they remain white, while in others they are slightly tinged with pink on opening, and while still fresh become purple, a form often confused with the very distinct *L. rubescens*.

In its native home the Californian *L. Washingtonianum* is found in practically only one soil and situation, but this Oregon form occurs in a great variety. At one point in the great Willamette Valley I knew of it in the grain fields, where it grew at a depth to escape the plough, and flowered magnificently. But to save their grain from being trampled by flower lovers the farmers dug them up.

Practically all of the bulbs which have found their way into gardens for some years have been of this species, so that it is now well known in cultivation.

While the bulb of the Californian variety is so liable to decay, that of the Oregon one is the easiest possible to handle, and there is as great a difference in the garden.

At my Lyons Valley garden it simply luxuriates in all but the wettest ground.

10*d*. In the Coast ranges of North-western California, in Humboldt and Trinity Counties, another very fine variation of the species occurs. It has an immense bulb, is tall and very leafy, with broad leaves, and the flowers open white and soon turn pink. It is of the general flower type of the Sierra *L. Washingtonianum*.

In cultivation *L. Washingtonianum* must be planted deep in a thoroughly drained soil. I should say that the ideal soil would be three-quarters sandy loam, one-quarter mould or peat, with a liberal admixture of grit or charcoal to make it porous; a sheltered position and some hardy perennial or low shrub to shelter the ground would complete its happiness.

11. *L. rubescens* is found in the Coast range from San Francisco Bay north to Humboldt County, from the immediate coast back for fifty miles. It grows in firm clay, in gritty soil, in gravel mixed with leaf mould, and among rocks. It is found on ridges in the open redwood forest growing through a low underbrush of Vacciniums and Gaultheria, on cool northerly slopes among the tan oaks (*Quercus densiflora*), on the inner edge of the *Sequoia* forest, among evergreen Oaks, on cool rocky points, and growing on cool slopes in hazel thickets east of Ukiah; but it reaches its best

estate on the high brushy mountains near Ukiah. There, among *Sequoia* and live Oaks kept in a dwarfed form by periodical brush fires, it finds shelter and lifts its glorious raceme above them into the warm June sunlight, the most deliciously fragrant of all Lilies. Here stems 6 to 8 feet high, with twenty-five to thirty-five flowers, are common. The soil is oftener a compact yellow clay overlaid by loose grit or mould.

L. rubescens has a bulb smaller, more compact, and more ovate than *L. Washingtonianum* of the Sierra Nevada. The leaves are narrowly lanceolate, nearly all in dense distant whorls. The stem is slender, the flowers in a raceme if many, in an umbel if few, have a narrow tube two-thirds their length, with recurving tips. The segments of the perianth overlap to form the tube. The peduncles are oblique to the stem, as are the buds, and the flower is semi-erect. This is in strong contrast to *L. Washingtonianum* or *L. purpureum*, in which the peduncles are oblique to the stem, but the buds horizontal.

L. rubescens is a much smaller Lily than *L. Washingtonianum*, and of altogether different flowers.

Very many growers have confused the two simply because *L. purpureum* was long sold as *L. rubescens*, and they have never seen the true *L. rubescens*. There is an excellent garden plate of *L. Washingtonianum* of the typical California Sierra form, and *L. rubescens*, which perfectly shows the two.

I note that in Baker's Tulipeæ *L. Washingtonianum* var. *purpureum* was referred to California and the Yosemite Valley. I have never seen any purple-flowered *L. Washingtonianum* in California except the Humboldt County one, and very likely the locality given is not a correct one.

I have found collected bulbs, no matter when or how carefully dug and handled, peculiarly subject to soft rot. On the other hand my garden-grown bulbs give me no trouble whatever. Why the difference I do not know, unless the presence of some germ in its native soil can account for it.

It is decidedly more amenable to cultivation than the Californian *L. Washingtonianum*.

I detailed the conditions under which it naturally grows fully on purpose to indicate garden treatment. First of all and always, perfect drainage, *sharp drainage*; next, any good deep soil not too rich, a dry or sandy loam preferable, and made porous in some way; last, the ground shelter of some undergrowth. These conditions or their equivalent will bring success.

12. *L. Kelloggii.*—This new Lily, a description and figure of which will be found in "The Garden" of May 11, 1901, is native to a restricted belt in Humboldt County, North-western California. It has the bulb of a small *L. rubescens* and darker similar foliage, the three to twenty flowers of a pinkish purple colour, the segments a couple of inches long, dotted with purple and banded yellow. The peduncles are curved and the buds pendent, the segments closely revolute. It is a distinct, graceful, and beautiful Lily, with a sweet characteristic fragrance. In height it varies from 2 to 4 feet as I grow it.

My experience in its culture extends through two years. The first

season a good percentage of mature bulbs flowered. The present season there is a splendid bloom. The best wild specimens had eight flowers. I have scores with more, and on one twenty. The soil is a deep, perfectly drained loam, rather dry.

Its native habitat is in the border redwood region under the conditions that *L. rubescens* thrives in, and the indications are for similar treatment.

13. *L. Bolanderi* is confined to a restricted area on the border between California and Oregon, perhaps fifty miles farther north than *L. Kelloggii* and as far from the Pacific. It grows through underbrush in open woods. In bulb, leaf, and stem it resembles the last two.

The flower is nearly erect and open, broadly funnel-form, a deep crimson spotted with maroon.

My garden experience with it is limited, but the indications point to a treatment as for *L. rubescens*.

I will close with a few notes on two interesting Lilies I have watched the last two years. They grow in sandy loam soil mixed with peat, in or about bogs in Sonoma County, California.

1. Bulb like *L. maritimum* of heavy scales, one or two jointed, rhizomatous, but not branching or forming clumps. Stem 2–4 feet high, 3–12 flowered. Leaves mostly in whorls, a pleasing medium green. Segments closely revolute, a deep clear red, tending to orange at centre and maroon spotted. Like *L. occidentale* a mean between *L. maritimum* and *L. pardalinum*.

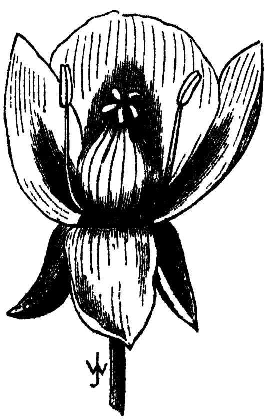
2. Bulb and leaf like *L. maritimum*. Flower very broadly tubular, almost campanulate, with the end of the segments slightly recurved. Colour a reddish orange, spotted in the throat. Possibly a form of *L. maritimum*, but strikingly different in the form and colour of the flower.

To resume, I would say that the best results with no Californian Lily can be obtained without good sharp drainage. No matter if they are thoroughly wet at times, there must be no stagnant moisture or sour soil.

All are at their best among low shrubs or perennial plants which shade the ground, but which they overtop in flower.

All like a porous soil, and to all charcoal especially is grateful.

All like trees as wind-breaks, but none are at their best in shade.



DUTCH LILIES.

By ERNST H. KRELAGE, Haarlem.

LILY growers in Holland have paid special attention to three groups of Lilies which they have succeeded in growing to perfection, in improving by sowing, and in monopolising as an article of their national bulb industry. I refer to the *elegans* or *Thunbergianum*, to the *dauricum* or *umbellatum*, and to the *speciosum* or *lancifolium* groups; for, although no known species or variety of Lilies would be sought for without result in the nurseries of the first-class firms, the three groups named alone contain those varieties which are grown in immense quantities in the Holland bulb district, and rightly deserve to be included in the familiar expression of "Dutch bulbs."

Having been honoured by an invitation to read a paper at the Lily Conference, I consider it a most pleasing duty to treat of what I ventured to call "Dutch Lilies" in particular, in the first place, on account of my nationality, but secondly, because, as a rule, far more attention is given in the British horticultural press to other kinds of Lilies. Consequently, it may be expected that others will not fail to choose other groups of Lilies as a subject for papers, whereas the groups referred to above seem to have less chance of being noticed.

1. THE THUNBERGIANUM GROUP.

The *Thunbergianum* Lilies are, with the *umbellatum* varieties, the first to open their flowers; only a very few other species are in flower at the same time. The name *Thunbergianum* is used here as being far more popular than the more correct specific name of *elegans*, which has the right of priority, being given by Thunberg, Professor at Upsala (1743–1828), in the "Memor. Acad. Petropolit." iii. 203, tab. 3, fig. 2. The same species, however, had also been described by the same Thunberg as *L. bulbiferum*, which is a perfectly distinct plant. Consequently, Thunberg's *bulbiferum* was changed into *Thunbergianum* by Schultés ("Syst. Veget." vii. 415), who seems to have overlooked Thunberg's description of *L. elegans* mentioned before. The Lily has often been figured under Schultés' name (for example, in the "Botanical Register," 1839, tab. 38, and in Maund's "Botanist," tab. 158, &c.); hence the Lily became generally known in gardens under the name of *Thunbergianum* instead of *elegans*. (Fig. 187.)

L. elegans is a native of Japan, where it is—as many Lilies—not only a native, but also a cultivated plant. The Japanese have obtained several seedlings which are decidedly distinct enough to be grown under separate names. The always brilliant colours vary from soft orange-yellow to the deepest scarlet; the height also of the stems varies a good deal, from twelve to twenty-five inches, but as a rule they are of compact, dwarf habit. The flowers are always borne erect on stiff stems: they are large, cup-

shaped, wide-opened. From the medium-sized compact white bulbs spring often three stems covered with narrow leaves and crowned with four flowers each.

The culture of the *Thunbergianum* group does not afford any puzzle or difficulty: they may practically be grown in any good garden soil and in any situation. They are perfectly hardy, which is very important, as they should be planted before winter on account of their earliness. They make splendid pot plants for the conservatory and can be easily forced.

For all these reasons the *Thunbergianum* Lilies deserve the attention of those who have not the accommodation for the more troublesome Lilies, or who did not succeed with the latter. On the other hand, the

FIG. 187.—LILIUM THUNBERGIANUM.

Thunbergianum group should be represented in every choice collection on account of its distinct characters, its brilliancy, and earliness.

It is doubtful whether the true *L. elegans* is still in cultivation. However this may be it will not be missed, as the two dozen varieties hitherto raised represent every shade and particular character wanted. A choice selection would include the following, viz.:—

Marmoratum aureum (*robustum*), the very earliest with tall orange-yellow flowers, conspicuously spotted with black. It received a First-class Certificate in 1882.

One of the very finest is doubtless still 'Alice Wilson,' which received the same distinction as long ago as 1877, and is always very scarce and expensive: it is a large clear lemon-yellow flower, very dwarf and quite distinct.

A striking contrast to this are the rich blood-red crimson flowers of *Vanhouttei*, one of the darkest, and also very large.

-- *Bicolor* (*pictum*), 1 to 2 feet high, has a yellow centre with red tips to the petals.

Brevifolium is an early variety with light-red flowers.

Citrinum is an unspotted form of a refined pale orange colour, rather stout and very distinct.

Fulgens, intermediate between *elegans* and *dauricum*, formerly described as a distinct species, has deep-red flowers.

Grandiflorum has medium-sized, erect flowers of a blood-red shade.

The "double" variety known as *flore pleno* has semi-double flowers of a deep red shade. Another variety with semi-double flowers is of a clear orange colour.

'Prince of Orange' is one of the best dwarf varieties, exceedingly pretty for borders and edging; colour apricot-yellow.

Venustum (*armeniacum*), a form of *fulgens*, is distinguished by brilliant orange-tinted flowers.

Venustum macranthum is a decided improvement, being an abundant bloomer with large unspotted brilliant apricot-orange flowers.

FIG. 188.—L. UMBELLATUM.

Wilsoni is very late and stout, about 2 feet high; flowers apricot with broad yellow band down the centre of the petals.

Horsmanni is a real gem, unfortunately very scarce; rich crimson, magnificent flowers.

A few good novelties have been added to the above assortment within the last ten years, viz.—

'Beautiful Star,' rich orange-red; 'Othello,' deep red, tinged orange; 'Beauty,' orange-tinged yellow; 'Sunset,' glowing golden chamois; and 'The Sultan,' dark crimson; all very bold and effective flowers, three of which were awarded First-class Certificate or Award of Merit by the Royal Netherlands Horticultural and Botanic Society in 1891.

2. THE UMBELLATUM GROUP.

The *umbellatum* Lilies are closely allied to the former group, and recent crosses between them and the *Thunbergianum* varieties have practically mixed up the distinct characters of each of them.

The type of this group is *Lilium dauricum*, a Siberian Lily, described by Gawler. It has the same habit as the well-known *Lilium croceum*, and flowers at the same time, viz. in June, with dark brown-red flowers. It is one of the earliest Lilies to open; most of its garden hybrids, however, are a fortnight later and more. (Fig. 188.)

The *umbellatum* varieties of gardens are taller than *Thunbergianum*, and are more abundant bloomers. The colours vary between the same limits, viz. pale orange and deep crimson. What is said about the easy cultivation of the *Thunbergianum* Lilies exactly applies to the *umbellatum* varieties, which want the same treatment in every respect.

The standard varieties of this section are very limited in number, but the assortment has recently been enriched by some valuable additions, being crosses between *umbellatum* and *elegans* varieties of Dutch origin.

The old varieties are: *erectum*, scarlet, with somewhat yellow shading; *incomparabile*, rich crimson, very showy; and 'Sappho,' scarlet with orange-tipped petals.

The new set of hybrids contains the following very showy varieties:—

Aurantiacum, inside orange-yellow, tips of petals orange-red.

Compactum multiflorum, very dwarf; same colour as *L. croceum*.

'Cloth of Gold,' nankin, almost unspotted.

Semiplenum, light orange-yellow, mottled black; half-double.

'Sensation,' very fine shape, elegant petals; vivid orange-red.

Superbum, medium-sized flowers of a clear orange-red, almost unspotted.

3. The Speciosum Group.

Lilium speciosum was found as a cultivated plant first by Kaempfer, and afterwards by Thunberg, in the gardens of Japan, its native country. Thunberg called it *speciosum*, by which name it is also at present best known, although it used to be generally called *lancifolium*, a name given by Mussche, the Curator of the Botanic Gardens at Ghent (Belgium), where it flowered for the first time in Europe in the summer of 1832.

Two years before Von Siebold, a surgeon attached to the Netherlands Embassy in Japan, to whom we are indebted for the importation of many beautiful Japanese plants, had introduced it for the first time in living bulbs into Europe, where it had only formerly been known from an unsatisfactory description by Thunberg, and from a drawing by Kaempfer, published by Banks.

When *Lilium speciosum* flowered in Ghent for the first time it created such a sensation that a well-known Belgium amateur at once offered 2,000 francs for the mother bulb, which offer, however, was declined. Mussche presented a very few offsets to horticultural friends, and so the Lily came into other hands. The prices for small bulbs were, in 1834, 200 francs each; in 1836, 150 francs; and in 1838 the stock was entirely sold out. No bulbs could be offered before the next year, when the price went back to 200 francs each.

At present numerous varieties of *Lilium speciosum* varying in colour from the purest white to delicate rose, and through all the shades of pink to fiery carmine, are grown in large quantities in the Netherlands and exported all over the world. Of later years some general trade varieties are also being yearly imported from Japan.

The variety known as *rubrum* is considered to be the type, although already in the first importation three different varieties were sent to Europe at the same time, and Kaempfer also had already found three forms cultivated in Japan, so that it cannot be said with any certainty if, indeed, this variety is rightly considered the type. (Fig. 189.)

The colour is a vivid carmine pink, and comes very near to that of the *speciosum roseum*, which, however, is a shade lighter. The stems of *rubrum*, moreover, are brown, those of *roseum* green. The third of the standard varieties is the white one (*album*), which also has a brown stem. Besides the above, there is a nearly white one with soft rose dots (*punctatum*), another with very dark flowers with a small light border on

FIG. 189.—L. SPECIOSUM.

the petals ('Melpomene'), and a form with broader petals (*Schrymakersi*), and indeed many others.

Monstrous forms with fasciated stems have been fixed and are known in the trade as *corymbiflorum* or *monstrosum*, in three colours. The number of flowers on each stem has much increased in consequence of the fasciation, but as a rule the individual flowers are small, too crowded, and very inferior to the other varieties.

Real improvements on the older forms are those newer varieties which produce more branching stems, and consequently an increased number of flowers of better and refined size and intense colouring. Such varieties are :—

WHITES.

Album novum, pure white with yellow anthers ;
Album, 'Crown Princess,' very abundant bloomer, fine pot plant ;
Album multiflorum, very floriferous ;
Album Kraetzeri, large white flowers, dark orange anthers.

RUBRUM.

Floribundum;
Incomparabile.

ROSEUM.

Multiflorum.

The *speciosum* Lilies do very well in any good garden soil: they like, as other Lilies, a position which is neither too hot nor too dry, and they are perfectly hardy. Planting may be done either in autumn or spring; if planted before winter some covering is needed.

The merits of the *speciosum* Lilies can hardly be exaggerated. They are most effective in gardens, and their cut flowers, which last very long in water, are invaluable for decorative purposes. The flowering season is rather late—viz. August-September—but, by forcing, the flowering period may easily be made earlier.

LILIUM SULPHUREUM, BAKER.

Bot. Mag. Tab. 7257.

By F. W. SEERS, Naini Tal, N.W.P., India.

THIS truly noble Lilium is indigenous to the Southern Shan States of Upper Burma, and is found in the jungles round about Taungyi. It has proved itself a species of great adaptability, since, under cultivation, my bulbs have constantly progressed and far exceed anything in a state of nature that has ever come to my knowledge, even indirectly; moreover, it stands with absolute impunity a full Himalayan exposure at an elevation of nearly 7000 feet. All seasons are borne with equal facility, and this fact says a great deal more than the mere words would convey to an European cultivator unacquainted with the Himalayan climate. April, May, and half June is a period of hot sunshine as a rule, and a dry heat, accompanied at intervals in most years with more or less violent storms. This year, however, the monsoon failed to reach my district until July 9, or nearly a month late. The heat was phenomenal, and the dryness great, and this state of things, while seriously damaging a number of Japanese Liliums, appears not to have affected *L. sulphureum* at all.

The general height of about ten-year-old bulbs is six feet, circumference of stems at base five inches, leaves about seven inches to five inches long by a quarter inch wide, studded all over the stem at about half inch apart mostly irregular alternate. The foliage of this Lily is very good and lasts far into the autumn, and the stems remain clothed from base to summit for a lengthened period.

The stems are very strong, and, notwithstanding the great weight of the flowers, I have never had to stake this particular variety.

The name *sulphureum* is a very good one, as the rich sulphur throat is conspicuous, but it must not be assumed by those who do not know the Lily that sulphur is the prevailing colour: in other words, that it is a sulphur type of yellow Lily; this would be wholly inaccurate. The sulphur is exclusively confined to the throat of the flower, and the reflexing portion of the segments turns a rich creamish-white, while the outside is neither white nor yellow, but a blend of somewhat vinous pink or pale purple mixed with a greenish tinge, and seen from a distance the very long large buds in a mass give the impression of a dull subdued pink flower.

The three inner segments of the flower have a pronounced prominent rib along the centre outside, but this characteristic is wholly lacking in the three outer segments of the flower. All the segments are characterised by massiveness similar to the petals of *Magnolia grandiflora* and it has stood almost with impunity the heavy rains of the Himalayas, amounting sometimes to six inches at a time, whereas this much rain has simply ruined any opened flowers of nearly all kinds of Japanese Liliums in my possession.

It commences to flower here the first week in July, but as a broad

statement it may be said that, compared with England, everything is about a month earlier in this part of the Himalayas.

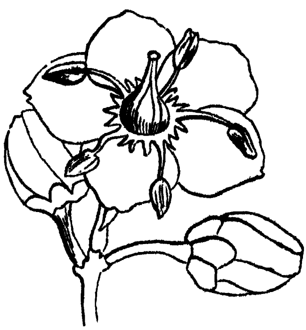
A large number of my bulbs have this year (1901) given fourteen flowers each, and one sixteen flowers, and a gentleman in Naini Tal who took some bulbs from me reports one as producing seventeen flowers.

The general average length of good flowers is ten inches, and they are exactly trumpet-shape.

My experience goes to show that it reaches perfection at ten years of age, and from that date the bulbs begin to divide, not, however, into a number of small offsets, but into nearly halves, so that a division this year, say, gives two equal bulbs next year of full flowering size.

It produces a great number of large bulbils every year; and this year I have for the first time some twenty very large seed-pods, each one of which contains a really enormous number of seeds. For five years attempts have been made to cross this magnificent Lily, and I am glad to report that, out of four flowers fertilised, two at length have succeeded and are developing seed-pods, and I hope in due course to get some red, or spots, as a result of the cross. Alas! it will probably take quite five years to know the result. I am of opinion this noble Lily would do well in sheltered places in England out of doors, but frost should under no circumstances be allowed to get to the roots. My bulbs are planted deep, quite five inches below the surface, as the stems make a great quantity of roots every year immediately above the bulb.

No special preparation of soil or site was given my bulbs. It, however, is worth recording that Himalayan comparatively new soil is a naturally good Lily soil, having abundance of humus, and is a soil, for a varying depth, of a purely vegetable character, directly derived from the original forest, previously removed for the cultivation of the land. An excellent point about *L. sulphureum* is that it delights apparently in full sun exposure. It has given abundant evidence of standing well full sunshine, drought, and most ample rainfall by turns. The flowers are delightfully scented, a very few scenting a very large room, and by night the scent is powerfully developed; it also lasts, cut, for a full week. The large amount of very bright new coffee-coloured pollen is not the least conspicuous feature of this plant. I confidently infer, so soon as stock is less scarce, and *L. sulphureum* is better known, that it will become one of the most popular Lilies in existence.



EXTRACT FROM A LETTER TO THE CHAIRMAN ON L. MEDEOLOIDES.

By ALFRED UNGER, Yokohama.

. . . Regarding *Lilium medcoloides*, on which you state in your "Monograph of the Genus *Lilium*," that there is probably an error in your plate, and that you must leave the matter of investigation to travellers and residents in Japan, I do not know if you were ever addressed in regard to the matter, therefore I venture to correct an error which exists in connection with this Lily. *Lilium medcoloides* (Japanese name "Kuruma yuri," that is "Wheel Lily," owing to the position of the leaves in whorls) grows here in Japan on the Fuji yama, and in the Nikko Mountains, and is exactly the Lily, bulb, stem, and leaves, which you reproduce in your plate, but the flowers are wrong, and should be like the single flower on the right-hand side of your plate, that is a flower belonging to the *Martagon* group. Neither I nor any of my employés, who have a great knowledge of Lilies, have seen *Lilium medeoloides* with other flowers in Japan.*

But last year, on a trip to China (Kiautschou), where I have rather important business interests with the German Government in connection with the reforesting of the mountains there, some Chinamen brought me a lot of Lily bulbs in flower which are exactly those of your plate with erect flowers.

Unfortunately just then the troubles in China began, after the Taku fight, and for that reason I could not go into the country where they grow; but took a number of bulbs with me and planted them here in my garden, where they are just now in full flower, and all my Japanese employés tell me that they never saw such a Lily in Japan before. There is, therefore, no doubt that the Lily which Mr. Oldham found in 1862 in Herschel Island near Corea, and of which he sent a dried specimen to Kew Herbarium, which Mr. Fitch used for painting your plate, is the same Lily which I found in Kiautschou, but not the *Lilium medeoloides* of Japan.

I am sending you herewith two specimens† pressed as carefully as possible, and should be pleased if this would help to bring a little more light into the history of this species, or possibly add a new species to the large genus of Lilies. I sent last year a number of these bulbs which I brought with me from Kiautschou to the Royal Gardens in Sanssouci, near Potsdam, thinking they might be of interest there, especially as they came from our new German colony. The shipment was duly acknowledged, but I do not know if they have flowered there. . . . .

*** At page vii. of his Monograph Mr. Elwes says: "If the very limited materials on which our knowledge of *L. medeoloides* is based do not mislead us, we have in it a species resembling the others (*Isolirions*), with which it is grouped in nothing but the (erect) position of the flowers; but . . . I cannot help suspecting an abnormal condition of the specimens on which it was founded." Mr. Elwes seems to us in this sentence to have exactly foreseen the precise condition of matters to which Mr. Unger draws attention.—ED.**

† These were sent to Kew, and Mr. J. G. Baker reports: "This Lily differs from *L. medeoloides* by the larger size and deeper scarlet colour of its flowers and by its longer style, but I think it can only be regarded as a variety of that species."

LILY DISEASES.

By GEORGE MASSEE, F.L.S., F.R.H.S.

FORTY-FIVE different kinds of fungi are known to grow on the various species of *Lilium*; some of these are quite rare and of interest only from the botanical standpoint, others do no harm whatever to the plant they grow upon; but, judging from what we know respecting the adaptive habits of many fungi, it is wise not to tolerate their presence on or about Lilies, notwithstanding the fact that nothing indicative of parasitism can be urged against them. A third lot, three in number, are too well known as destructive pests, which every now and again, when climatic and other conditions are favourable, manifest themselves under the form of an irrepressible wave of disease.

These three kinds of fungi will be considered in the order of their relative destructiveness.

BOTRYTIS CINEREA, Pers.

Some years ago Professor Marshall Ward gave an exhaustive and beautifully illustrated account (1)* of the life-history of a species of

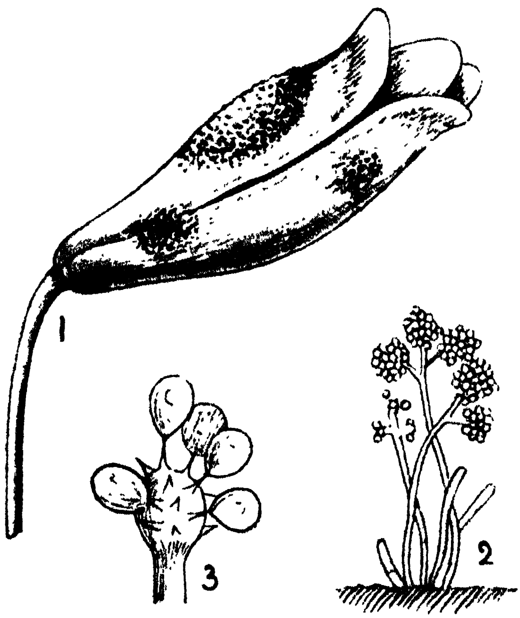


FIG. 190.—BOTRYTIS CINEREA. 1. Flower-bud of Lily attacked by the fungus. Nat. size. 2. Fruiting branch of the fungus: × 50. 3. Head of fruiting branch: × 500.

Botrytis that caused orange-brown or buff specks to appear on the stems, pedicels, leaves and flower-buds of *Lilium candidum*. These specks gradually increase in size and become covered with a delicate grey pile, consisting of the fructification of the fungus. When this stage is reached

* *See* p. 376, "Literature Quoted."

the parts attacked are either completely destroyed or so disfigured that the plant is rendered worthless.

When this disease appears, it usually assumes the dimensions of an epidemic, attacking every plant in the vicinity, owing to the fact that the fungus has become a true parasite in the sense of its mycelium being capable of penetrating the substance of the host-plant immediately on germination, whereas in many kinds of *Botrytis* the mycelium first produced on the germination of the conidia, or reproductive bodies, requires to obtain its food from dead organic matter, present in the soil or elsewhere, for some time before it is capable of penetrating the tissue of a living plant.

The rapid extension of the disease during the summer months is due to the conidia formed on the delicate grey mould being conveyed by wind or other agents from one plant to another, every conidium alighting on the surface of a damp leaf or flower-bud being capable of producing a diseased spot.

In the meantime numerous conidia fall to the ground, where they germinate and form a mycelium, which obtains its food from organic matter present in the soil. This mycelium continues to grow, and eventually forms a cobweb-like weft, which often proves very destructive to seedlings of various plants. When this mycelium develops in the soil in greenhouses, &c., it continues to spread for years if the soil is not entirely removed and the house thoroughly sterilised, never producing fruit, and attacking almost indiscriminately all kinds of plants, especially during the seedling stage. This destructive vegetative condition of *Botrytis cinerea* is very well known in France under the name of *la Toile*, and is far more widely diffused in England than is generally supposed (2).

The mycelium that forms in the ground in the open air remains passive during the winter, and, on the return of spring, produces a crop of conidia, some of which find their way on to the leaves or flowers of Lilies. In some instances the mycelium in the ground attacks the scales of Lily bulbs, where it forms numerous small, externally black, hard bodies called sclerotia, which are more or less embedded in the flesh of the scales. During the following season these sclerotia either directly or indirectly give origin to conidia, some of which find their way on to the foliage of Lilies.

In Bermuda the cultivation of the 'Easter Lily'—*Lilium Harrisii*—is conducted on a large scale, mainly for the New York market, and since 1885 a disease, which has continued to spread annually and threatens to extinguish the industry, has been shown by Kean (3) to be identical with the *Botrytis* disease described above. In investigating this disease Kean observed that certain Lilies sheltered from the heavy dew by growing under Oleander hedges were not diseased. Literally interpreted, this observation means that the conidia of the fungus cannot germinate and enter the tissues of a leaf with a dry surface, and the hint given is significant. Another pathologist, who has investigated the same subject in Bermuda, attributes the disease to a variety of causes, but mainly to the attacks of the bulb mite—*Rhizoglyphus echinops* (4). My own experience of this mite is that it is not a primary cause of disease, but rather that it performs the functions of a scavenger, consuming diseased

portions of the bulb that have been more or less weakened by other agents; there is undoubted evidence to show that the mite will pass on from diseased to sound portions of a bulb, but, so far as I can ascertain, there is no reason for believing that the mite attacks sound bulbs, thus originating a disease.

Owing to the size of the conidia and other differences, Professor Marshall Ward could not reconcile the *Botrytis* causing the Lily disease with that of any species described in books, and consequently did not assign to it a specific name. I have had the species under observation for the past ten years, and, from artificial cultures carried on under very varied conditions, have come to the conclusion that we are dealing with a highly specialised form of *Botrytis cinerea* Pers., which, as I have shown elsewhere in this Journal (5), is a very variable species, and capable of undergoing material modification in matters of detail in its various specialised forms. No ascigerous condition has been observed as forming part of the life-cycle of the Lily *Botrytis*.

Preventive Measures.—Most unfortunately, notwithstanding the appearance of innumerable articles couched respectively in persuasive and sarcastic terms, commenting on the tardiness of plant cultivators in adopting preventive measures against plant diseases caused by fungi, the almost total absence of the exercise of such measures would suggest that the practical man had no confidence in the advice given by the mycologist. The saving clause against this opinion is the fact that mycologists and editors are flooded with diseased plants when a given epidemic has reached such a stage that the only possible reply is—*Too late.*

Taking our preventive measures piecemeal:—Assuming we have a bulb free from *Botrytis*, it is only fair to suppose that the mycelium of the fungus is present in the soil. To guard against infection, make a hole in the soil three or four times the size of the bulb, fill it with quartz sand in which a dessert spoonful of sulphur has been mixed, and plant the bulb in the middle of the sand. By adopting this method we practically prevent the formation of sclerotia on the bulb, as mycelium cannot pass through sand owing to lack of food.

A gardener whose land was evidently infested with *Botrytis* mycelium, and whose Lily bulbs were in consequence destroyed annually, undertook, amongst other preventive measures, to plant his bulbs in sand. He afterwards informed me, according to agreement, of the result, and apparently quietly enjoyed stating that the experiment was a failure: "the Lilies kept clean and did well for three years, and the fourth year the disease showed again." I then suggested replanting bulbs in sand every fourth year, and the reply was "that would be a good plan." This particular gardener was an admitted expert, and within his own circle of light could be relied upon; but, unfortunately, preventive measures against disease were a subject outside his circle, and consequently considered as of very minor importance.

Returning to preventive measures:—The surface soil covering bulbs should be removed every autumn, and replaced by soil mixed with kainit, which destroys fungus mycelium. For the same reason, manure used for mulching should be mixed with kainit, which practically sterilises it, and at the same time is in itself a good fertiliser.

Finally, if the foregoing precautions have been neglected and the fungus appears on the foliage, spraying should be resorted to, using a solution consisting of two ounces of potassium sulphide dissolved in three gallons of water. The soil should be thoroughly drenched at the same time with a solution double the strength of the one given above.

Always bear in mind the fact that fungus spores cannot germinate on the dry surface of a leaf or flower; and, furthermore, spores can only exist when the fungus is fruiting somewhere close by. Therefore decaying vegetable matter should not be allowed to lie about, and the more frequently the surface of the soil is broken the less opportunity is afforded for the mycelium of the fungus gaining a foothold in the ground.

UROMYCES ERYTHRONII, Passer.

This fungus is one of the "rusts," and although at present rare in England, there is the possibility, in fact the probability, of its being im-

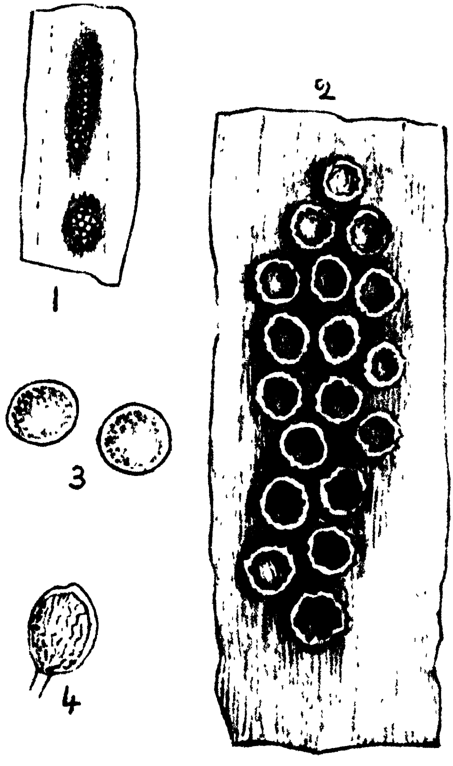


FIG. 191.—UROMYCES ERYTHRONII. 1. Portion of a leaf showing clusters of the fungus. Nat. size. 2. A single group of the fungus fruit known popularly as "cluster-cups": × 100. 3. Uredo, or summer-spores: × 400. 4. Teleuto, or winter-spore: × 400.

ported from the Continent, where it is abundant, and at times does a considerable amount of injury, not only to several species of *Lilium*, but also to species of *Scilla*, *Allium*, *Fritillaria*, *Muscari*, and *Erythronium*. The fungus also occurs in Asiatic Siberia and in North America.

The foliage is the part attacked. First appear the spermogonia under

the form of yellow pimples arranged in groups, and so exceedingly minute that they are very likely to be overlooked; next follows the well-known "cluster-cup" or æcidium stage, appearing under the form of crowded cavities filled with yellow powder, and surrounded by an irregularly notched border when seen under a magnifying-glass. This phase of the fungus does most harm, forming large discoloured blotches on the leaves. Later in the season the winter-spores develop under the form of minute brown spots on the fading leaves.

Preventive Measures.—However badly a plant may be attacked, there is no permanent mycelium present in the bulb, hence the Lily will commence growth next season perfectly free from disease and remain so unless inoculated by winter-spores that had been produced on some leaf the previous season; hence it is most important that all diseased stems should be removed and burned before the leaves fall to the ground. If this is done there can be no disease.

Rhizopus necans, Massee.

During the years 1896-7 this fungus was the cause of a widespread epidemic which almost destroyed the crop of Lily bulbs grown in Japan for exportation to Europe. In one instance, out of a consignment containing 78,050 bulbs of *Lilium speciosum* received in London only 250 bulbs were in a saleable condition, and this was by no means an isolated instance.

The disease first attacks injured roots and afterwards passes into the bulb, which changes to a brownish colour and finally rots away. A full account of this parasite has been given elsewhere (6).

The fungus hibernates in the soil where the bulbs are grown, and gains an entrance through roots that are broken or injured during the removal of the bulbs from the ground.

Preventive Measures.—Care should be exercised when removing bulbs from the ground to injure the roots as little as possible, and it is very important that no "sweating" should take place after bulbs are packed or stored.

Freshly-burned wood-charcoal crushed to a coarse powder, to which a sprinkling of flowers of sulphur is added, is an excellent packing material in which to keep dormant bulbs, as it not only prevents outside infection but also destroys any spores or mycelium that may have been packed away along with the bulbs.

Literature Quoted.

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2. "Le *Botrytis cinerea* et la Maladie de la Toile," H. Prillieux. *Comptes rendus*, (1889) I. p. 846 and p. 1251.

3. "The Lily Disease in Bermuda," A. L. Kean. *Bot. Gaz.* XV. 8 (1890). 1 pl.

4. "The Bermuda Lily Disease," A. F. Woods. *Bull, U.S. Dept. Agric.* No. 14 (1897). 4 figs. in text.

5. "A Snowdrop Disease," Geo. Massee. *Journ. Roy. Hort. Soc.* XXVI. p. 41 (1901). 1 pl.

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NOTES OF MY EXPERIENCE WITH LILIES.

By George F. Wilson, F.R.S., V.M.H., &c.

Lilium rubellum.—Being a great admirer of this recently introduced Lily, and believing that it will become a garden favourite soon, I begin with a short note upon it.

As we were desirous to ascertain the best way to grow *Lilium rubellum*, I got a number of imported bulbs and planted them in lots of ten or more, in very many situations and under very different conditions, in October 1899. The result is that we found a mixture of vegetable soil and loam, and a partially shaded situation, were what suited them best. I send you a photograph (fig. 192) of a clump in flower in partial shade at the side of a bed of hybrid Azaleas, one of the Lily stems carrying three flowers.

Both this clump and another planted in the deep shade of a wood bloomed thoroughly well, but the one with more light had the higher colour.

General Culture.—Though my experience in Lily-growing dates back to a time when cultivators in general had not been awakened to the charms of this most beautiful family, I must still confess that we have many things yet left to learn, and perhaps some to unlearn. In some seasons, notably when cold and wet follow after drought, even practised cultivators, except in most favoured situations, find that "blight and spot" greatly injure the growth and flowering of some species, even though the bulbs may be unhurt.

The best situation for planting Lilies—at least in the southern counties—is a cool sheltered one; a very safe place is near the edge of a Rhododendron bed; soil that will grow Rhododendrons will also answer for most kinds of Lilies. I can give two examples where Lilies succeeded when left almost to themselves: one was in an old-fashioned garden with a small lawn inside the main lawn, and sheltered and partly shaded by shrubs and trees. In the centre bed, among some dwarf Rhododendrons, I planted many kinds of Lilies, all of which succeeded perfectly. Blooms of *Lilium auratum*, gathered after a week of unusually stormy weather, were taken up to the Royal Horticultural Society to show how little they had suffered. In the same garden *L. auratum* and *L. longiflorum* bloomed well in a peat Rhododendron bed, sheltered by the house, in a full southern exposure; but in this case watering was almost essential. The other situation is in the garden of a friend; his *L. auratum* are planted near the edges of large Rhododendron beds, and are partially sheltered by a high bank, and by belts of trees at some little distance; his Rhododendron soil suits the Lilies admirably, and there appears to be moisture in the soil some little way down which the roots can reach. The result is that season after season, even in the most unfavourable ones, hardly a Lily is injured, and their flowers, on stems from 6 to 11 feet in height, surpass any I have seen elsewhere.

In Lancashire, not far from Rochdale, a friend has long grown *L. speciosum*, blooming it well in an exposed border without taking up the bulbs.

Most gardens have a north border where there are spaces between

FIG. 192.—L. RUBELLUM, IN MR. G. F. WILSON'S GARDEN.

small shrubs; if a little peat and sandy loam is dug in, and the bulbs planted 5 or 6 inches deep, Lilies are almost sure to thrive. Some Lilies, however, such as *L. candidum*, *L. Martagon*, *L. Szovitsianum*, and *L. chalcedonicum*, require a stronger soil and like loam.

All the Tiger Lilies grow well in ordinary soil; the old *L. tigrinum*

sinense is well known in gardens, but *L. tigrinum splendens*, which richly deserves its name, is but little known. Very many bulbs of *L. tigrinum Fortunei* (fig. 193), which has a very woolly stem, are sent out in mistake for *L. tigrinum splendens*, the original error having been widely extended by means of stem bulbs. *L. tigrinum splendens* has more the character of the old *L. tigrinum sinense*, only magnified in height, size of flowers, and especially size of spots. It shows beautifully in Rhododendron beds, in the centre of other beds; indeed, in any situation in which its height—7 or 8 feet, or, with large bulbs, probably 9 feet or more—does not disqualify it. *L. tigrinum flore-pleno* (fig. 194) is a showy Lily which lasts long in flower. I think *L. tigrinum erectum* a desirable variety, but with this opinion the Floral Committee of the Royal Horticultural Society used not to agree.

Lilium longiflorum, with its varieties *eximium*, *Takesima*, &c., sometimes blooms very well in borders, but care should be taken that it is

FIG. 193.—L. TIGRINUM FORTUNEI.

FIG. 194.—L. TIGRINUM FLORE-PLENO.

not injured by spring frosts. This Lily is such an early one that, unless protected by the leaves of the Rhododendrons or otherwise, its growth is apt to be checked. (Figs. 214, 219.)

This season I have one clump of *L. giganteum* with no fewer than fifteen stems and a multitude of expanding flowers.

The comparatively recently-introduced North American Lilies, such as *L. Humboldti*, *Washingtonianum* (figs. 195, 202), *puberulum*, *pardalinum*, *Robinsoni*, *californicum*, &c., no doubt will soon be grown perfectly in borders; but here, at least, though some thrive well, others, in places where they ought to succeed perfectly, have not always done so, the foliage of *L. Humboldti* especially not keeping its healthy colour. Cultivators must not be discouraged when newly-imported bulbs do not show up the first season. I have just been examining two small beds, in each of which twelve fine bulbs of *L. Humboldti* (fig. 188) were planted. The soil of one bed consists of two parts of peat and one of loam, the other of loam with a little sharp sand mixed; in neither bed the bulbs made upward growth, but,

on examination, seem healthy, and have made roots. In adjoining beds, with the same two soils, a dozen *L. Szovitsianum* in the peat and loam made miserable growth, while the dozen in the loam and sand bed have, many of them, flowered well and seeded. In other two beds with six *L. auratum* all came up fairly, but in the loam and sand bed the six were rather the stronger; all the bulbs were newly-imported ones. The above, I think, shows that imported bulbs of different Lilies take different times in establishing themselves, and that with cold and wet in the early part of the season the soil which suits Lilies best in normal seasons may not then give the best results.

Many of the varieties of *L. superbum* are very beautiful; they like shade and rather moist soil. (Fig. 196.) Some years back—I do not know whether it still exists—there was a grand undisturbed bed of *L. superbum* at Messrs. Waterer's at Woking; the Lily was at home in the moist peat; the great tall stems, with richly-coloured flowers, had a very fine effect.

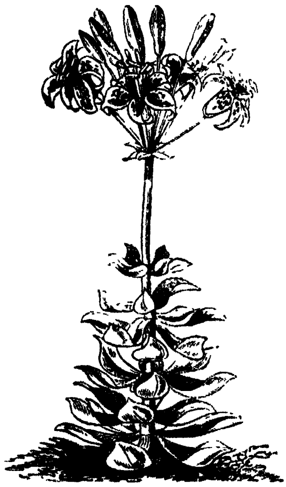


FIG. 195.—L. WASHINGTONIANUM PURPUREUM.

FIG. 196.—L. SUPERBUM.

L. canadense, in all its varieties, grows easily and is very beautiful. It is usually said, "Find the native habitat of a plant, and reproduce it as nearly as you can; if a Lily be found in shady places, grow it in shade"; but a distinguished Dutch chemist-botanist, who has himself done great things as regards the introduction of different plants, especially into Java, once showed me that this was not a universal law, or rather that what appears to be the reproduction of the habitat is really not so, and that one unattainable condition sometimes changes the whole circumstances so completely that he had known plants which, in their own country, flourished in shade, when transported, throve best in sun. The moral is, I think, where possible, try experiments for yourself, plant a few bulbs in very different situations—the first year will tell you in which direction to steer.

One thing which I have learnt of recent years is that in situations and soil where Rhododendrons grow very luxuriantly, after

a time they too much overshadow Lilies planted among them, and now that there are so many beautiful forms of hardy Azaleas, especially hybrids of *A. mollis*, we have used these as shelter for Lilies, and in several beds where the experiment has been tried it has proved eminently successful.

POT CULTURE.—I must end with a few words on pot cultivation. We have some thousands of bulbs, both little and big, planted in the open, but I think there are some species which cannot be brought to their full beauty except under a roof. Perhaps the simplest way is to mention how our Lilies are treated; which species succeed well here; and

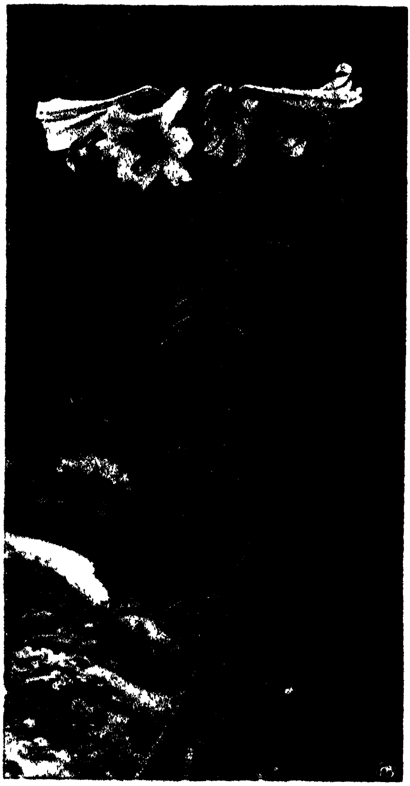


FIG. 197.—L. WALLICHIANUM SUPERBUM.

which do not. Till lately the Lily-house was an orchard-house, 60 feet by 20. In this Lilies answered very well except in very hot weather, and then some of them, when in bloom, were moved to a rough shed, open at the front and facing north. Last year a house was put up, giving as much air as possible, in our shadiest corner; it gets only the east sun. The Lilies succeed very well, and the blossoms last longer than in the orchard-house. Had we the situation, a house should be placed in complete shade, for I feel sure that some Lilies would thrive best there. The soil we use for most Lilies consists of two parts fibrous peat, one part loam, and, if the last is at all stiff, some sharp sand is added. In

this *L. speciosum, longiflorum, canadense, californicum, pardalinum, parvum, puberulum, Thunbergianum, Coridion, Hansoni, tigrinum, giganteum,* and some others, flourish and increase; *L. auratum, Krameri, superbum,* and *Leichtlinii,* in some seasons. The last, from its distinctness, is a favourite here; we are trying it with more loam. *Chalcedonicum, tenuifolium, Buschianum,* white *Martagon,* &c., bloom for a time, but the bulbs waste and we lose them. *L. Brownii* occasionally succeeds splendidly, but is uncertain; we continue trying different soils and earlier removal to the cooler house. I will not speak of some of the rarer Lilies, such as *polyphyllum, neilgherrense,* and *Wallichianum* (fig. 197), for we have not yet quite mastered their treatment.

LILIES FROM SEED.

By F. W. Burbidge, M.A., V.M.H.

In this short paper I beg to urge the more frequent rearing of garden Lilies from seed, as ripened in British gardens, and sown for the most part in the open air.

So far but few hybrid or cross-bred Lilies have been reared in English or Irish gardens, and I have long felt, with other growers and admirers of these handsome and popular flowers, that, in suitable climates and on genial soils in these islands, much more good work might be done in this way.

Apart altogether from cross-breeding, however, I urge the rearing of seedling stocks of all the hardiest and best of garden Lilies, because I believe that home-grown seedlings have a tendency to be hardier and more vigorous, or in any case are more adaptable to the soil on which they are raised, than are imported bulbs and their offsets, which are at present almost entirely relied upon in our gardens.

Nearly all the species and many of the varieties of Lilies seed so freely, especially if their flowers are carefully pollinated, that, so far as good sound seed is concerned, there is little or no difficulty in the matter. A few good hybrid and cross-bred Lilies have been raised in England and in America, on the Continent, and also, either naturally or artificially, in Japan; but, as I before said, it is not so much cross-bred variations that are required as new-born and healthy stocks of a llthe best-known garden species; and such stocks, I hold, can in no better way be obtained than from home-grown seeds as grown on British soil. Seedling plants very often possess strong and healthy constitutions, and succeed far better than vegetative or divided stock.

We want at least one cultivator to do for our garden Lilies what Mr. Engleheart has done for our Daffodils, and I think that we should then hear far less of Lily failures and of the Lily fungus disease. Apart altogether from variations in form or colour, we shall be able to obtain healthier and more permanent stock bulbs from seedlings, as reared at home under cultivation, than we shall by the almost invariable planting of imported bulbs.

This is true of all bulbous as well as of other garden plants and flowers; but Lilies have never received the attention in this way that they really deserve. As I have said, hybrid Lilies have been raised in England, and the late Mr. Isaac Davis, of Ormskirk, used to raise fine healthy stock of *Lilium auratum* and of its varieties—and especially of the red-rayed *L. a. cruentum*—from seed. He had a splendid Rhododendron and Azalea soil, which suited many Lilies, and especially the gold-rayed *L. auratum*, perfectly; but he used to attribute much of his success to the fact of there being *new life* in the seedlings, whereas the offsets and scales merely reproduced the life of the original imported bulbs, which not unfrequently contained within them the fungoid or other germs of disease.

It is difficult to get at the exact origin of the many variations of such Japan Lilies as *L. auratum*, or of *L. speciosum* (*L. lancifolium*) ; but it is fair to assume that such fine strong forms of the one, such as *L. a. platyphyllum, virginale, cruentum*, &c., were either wild or garden seedlings, as also were those variations of *L. speciosum*, such as *L. s. rubrum, album, Krætzeri, Melpomene*, and others. Now, broadly speaking, all these forms are more vigorous and more easily grown, and in other ways more satisfying, than are the common types, and the lesson they teach us seems to be an obvious one.

No plant, no group of species, can be said to be at its best in our gardens unless it is, at least now and then, reproduced from seeds. There are, I know, some few seeming exceptions, such as the Banana or the Pineapple, but these only serve to prove the rule. All our finest of crops in field or in garden require new life and vigour infused into them from time to time, and this, in the case of the cereals, the root crops, and many other flowers, fruits, and vegetables, is effected by hybridism, cross-breeding, or by simple seminal reproduction and selection, such as I especially recommend in the case of all our best and most handsome garden Lilies.

I need not go into details as to the culture of Lilies from seed, as each grower who really wishes to so grow them will have ability and patience enough to strike out the methods and technique best adapted to his own climate and soil. All over England and Ireland there are here and there especially good Lily soils where they luxuriate; with all natural advantages seedling Lily culture would not be a difficult or exacting pursuit, and the results might prove very far-reaching and highly satisfactory to the cultivator.

LILIES IN A TOWN GARDEN IN THE NORTH.

By George Yeld, M.A., F.R.H.S.

"Lilies did you say? Oh, yes, they are beautiful things, no doubt, but '*miffy*'—I can do nothing with them." This is the tone, if these are not the actual words, in which the ordinary town gardener in the North will talk of Lilies. Nor do I much wonder at it. When people speak of the glories of Lilies in the South of England the words come naturally to the lips of us poor Hyperboreans, to describe the Southron's garden,—

> Oh, richly soiled, and richly sunned,
> Exuberant, fervid, and fecund.

And we are tempted to add—if we had your climate we might grow Lilies as you do. Yet with all our disadvantages I have derived much pleasure from the attempt to grow Lilies in a York town garden, and, as I believe that most gardeners can say with truth,

> In nature's infinite book of secrecy
> I can a little read

(though I am not so sure about myself as I was a few years ago), I propose to deal very briefly with my experiences as a grower of Lilies.

I must premise that my garden, while it has the usual disadvantages of the North in poverty of sun and warmth, and excess of dampness, possesses one distinct advantage—it is well sheltered. The taller trees of

Fig. 198.—L. Martagon.

my neighbour's large—I might almost say park-like—garden, and my own shrubs form a very effective protection, and the wind does me very little mischief. Even the gale that laid low the tents at the York Gala in 1898 wrought me very little damage. Then, again, I spare no trouble in getting in new soil—without it, indeed, I should despair of growing *Iris* and *Hemerocallis*, let alone Lilies. Add to this careful attention to the plants themselves, and you have all that can be said in the garden's favour.

As to the Lilies which I find comparatively easy to manage: the

common *Martagon* (fig. 198) will grow anywhere; it does not object to thick shade. In fact, I have a big clump under Pear-trees which is quite an effective feature when in bloom. A seedling 'Wood-nymph' is much prettie than the type. *L. dalmaticum* hardly does itself justice, and is given to deteriorating. *L. pyrenaicum*, when raised from seed, quite surprised me, for, though it is amongst the least showy of Lilies, it asserted itself to considerable purpose. *Martagon album* I can manage fairly well. *L. Hansoni* also does well, but it is so early in throwing up its flower-stems as to be liable to be caught by frost. This year, for example, half-a-dozen strong spikes had not one flower amongst them. It may be

FIG. 199.—L. TESTACEUM.

interesting to note that *L. Hansoni* at the York Nurseries was this year in full flower in the second week in July. This was due to the bulbs having been replanted late (in the first week in March).

L. testaceum (*excelsum*) (figs. 199, 200) does well when I look after it. I may mention that one of the finest specimens of this Lily I have ever seen, grows in the garden of my friend Dr. Tempest Anderson in Stonegate, in the very centre of the City of York—a few yards from the Minster. It has flourished there for years. *L. chalcedonicum** (fig. 201) does only moderately well; when in flower it usually has an untidy

* Mr. W. A. Clark, F.R.H.S., who has had great experience in Lily growing, tells me that *L. chalcedonicum* does much better on the limestone or chalk than in ordinary garden soil. So also does *L. pomponium*.

appearance, owing to the withering of the leaves on the lower part of the flower-stem. In St. Peter's School garden, a very short distance from my house, there is a fine clump of this Lily which has been in the same place for more than twenty years. The bulbs have at intervals been taken up and replanted in new soil. This clump is a fine sight when in flower. I know of a small clump of this same Lily in Clifton; it grows in a spot which I should have imagined no self-respecting plant would condescend to exist in, and flowers well. The only place in which I have seen this Lily in flower with the stem-leaves green is Göschenen, at the entrance to the St. Gothard tunnel, where a fine clump absolutely commanded my attention.

Humboldti I once had very good from imported bulbs kept in the cellar, in sand and planted late. They may of course have taken a stimulant in the cellar, as after delighting me for two seasons they pined away. Of *Humboldti magnificum* I have one bulb doing well for the third summer in succession. It is both brilliant and attractive. (Fig. 183.)

Washingtonianum is one of my failures, though I once had it with

FIG. 200.—L. TESTACEUM.
(Showing habit.)

FIG. 201.—L. CHALCEDONICUM

eight flowers. I have never seen this Lily doing so well as at the York Nurseries in a position heavily shaded by Alders and Yew, where it is well sheltered from winds, and must always be cool. A very fine bulb from this spot transferred to my garden sent up four stems, but only gave one flower, and evidently resents its change of home. (Fig. 202.)

Canadense does not approve of my garden; but *superbum* does well, though I have not supplied it with peat.

Pardalinum has never been good with me but once, and that was when I made a big bed of new soil for it. (Fig. 184.)

Pomponium verum and *tenuifolium* do well for a little while—but only for a little while.

Of *polyphyllum* and *sulphureum* I can only say that their cost was great, but their vitality little; neither ever flowered.

Parryi I find fairly good-natured; even little bulbs flower, and I *have had* as many as six blossoms on a stem; but an attempt to obtain seed, which was moderately successful, apparently weakened the plant so much that it has done no good since. (Fig. 185.)

Colchicum.—This, as far as my garden is concerned, is the finest of all Lilies. It grows best in a fairly deep rich soil in partial shade, though it will do well almost anywhere, provided the soil is good. My best bulbs have been raised from seed, and have given me as many as

FIG. 202. - L. WASHINGTONIANUM.

thirteen or fourteen flowers on a stem. It is true that they took ten or eleven years to flower, but the blossoms amply repaid me for the long waiting.

In 1890, when mountaineering without guides with Mr. G. P. Baker, a fellow-member of the Alpine Club, I collected in Daghestan, on our

way down from a successful ascent of Basardusi, in the Eastern Caucasus, seed of what I believe to be this Lily, but the bulbs have not yet flowered! Another two years, however, will settle the question as to whether they are *L. colchicum* or a variety of it. No collectors are likely to have been where I found the seed, as I do not think any traveller had visited the Lily's actual habitat.

L. colchicum is much more effective when the pollen is of a fiery red-orange colour; sometimes it is of a dullish yellow, when the general appearance of the plant suffers in consequence.

Thunbergianum Van Houttei is excellent.

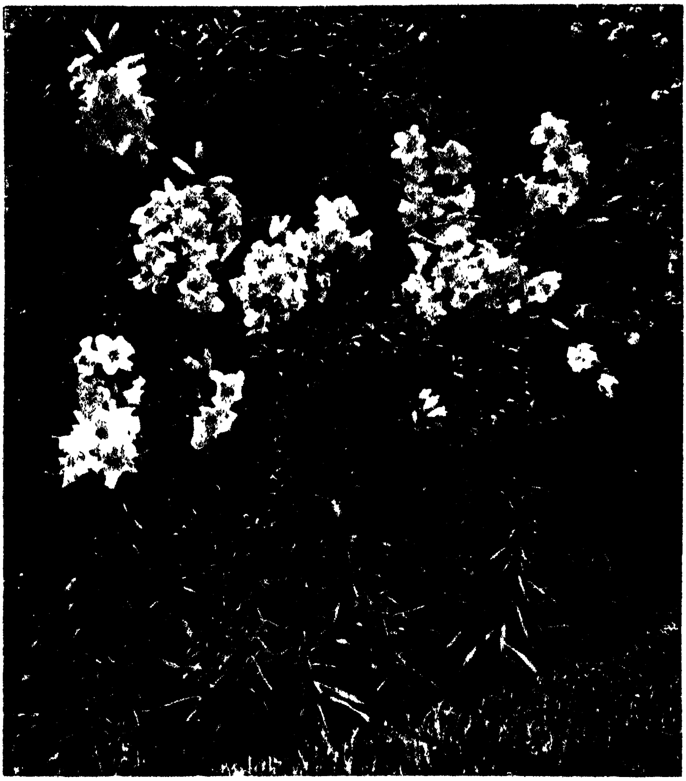


FIG. 203.—L. CANDIDUM.

Brownii (which should not be planted deeply) does fairly well, but has a tendency to dwindle away.

Giganteum is occasionally splendid, but is liable to rot in the spring. Care should be taken in planting to leave the upper portion of the bulb out of the ground. The soil round the base of the bulb should be made perfectly firm. My experience is that it does well on an artificial mound.

Batemanniæ is good, *tigrinum* only moderate, *croceum* very fair.

Speciosum Krætzeri I once had excellent, but generally speaking the *speciosum* flowers too late for our climate, except in well-drained positions facing full south. This year all the varieties of *speciosum* have been splendid at the York Nurseries in partial shade, and I have cut flowers in my own garden as late as October 30.

Auratum does well, but the bulbs must be replaced at no long intervals to make sure of a display. *Virginale* is best. Very often the small bulbs do better than the large ones.

Candidum, with me as with others, is capricious. (Figs. 203, 204.) This year it is splendid. Care must be taken not to plant it too deep. It should be given as sunny a position as possible.

I have found many Lilies do well among the roots of trees, but I put that down mainly to the fact that my garden has an excess of moisture, and that the tree-roots help the Lilies to bear with it.

In ordinary seasons the plan of planting Lily bulbs in positions secured against excessive moisture by the presence of tree-roots succeeds well. This exceptional season (1901), however, has been so dry that the bulbs have not obtained sufficient moisture. I have never seen the Lilies look so unhappy from sheer want of water.

I am, by careful experiment, arriving at the conclusion that Lilies are not so impatient of manure as I used to be told they were. This year,

FIG. 204. - L. CANDIDUM. (Showing habit.)

certainly, they did not object to what I may call a mellow vintage of it. In a wet season the case would possibly be very different.

The principal points to observe with a view to success are—Position and exposure, drainage, soil.

1. Above all, assure your drainage.
2. Get new soil from time to time.
3. Never move a Lily that is doing well.
4. Give an eye to the flowers, lest insects work mischief.

Lilies may be exacting and fastidious, but care and patience can do much; and if sometimes one's losses almost induce despair, yet occasionally an unexpected success makes up for many failures. Moreover, in a garden like mine, which fails to conciliate the Rose, Lilies go far towards providing that fragrance which so many flowers lack, and consequently (like a beautiful woman without a sweet temper) fail to charm. "Fortune favours the brave" is a motto which, if novelists speak truth, has helped many a lover to triumph, and will serve equally well for the grower of Lilies; and if success, like the lover's delight, does to some extent "go by favour," yet we may most of us, even in the North, snatch enough of it to make Lily-growing a delightful occupation.

LILIES IN THE OPEN-AIR GARDEN AND WOODLAND.

By W. Goldring, F.R.H.S.

My part of the subject deals with Lilies purely from the point of view of their great value in beautifying the open-air garden and woodland.

The commoner kinds of Lilies we all of us know. Most of them we have known from childhood, and particularly those we always associate with the cottage and farm-house garden, where they have survived the changes of fashion that have overspread the gardens of the mansion and the villa. The masses we see to-day in the cottager's garden of the lovely Madonna Lily, of the Orange Lily (fig. 205), of the yellow and scarlet Martagon or Turk's-cap, and of Tiger Lilies remind one of what was a common sight in days gone by in the large mansion gardens before the

Fig. 205.—L. croceum.

change to the "bedding-out" period, which banished many a beautiful hardy flower from English gardens.

Though there is a reaction in the taste of garden lovers in the appreciation of purely hardy flowers, there is still much reason to plead for the more extended cultivation of Lilies, as their absence from gardens generally is everywhere conspicuous, except in the case of a few of the commonest and most popular kinds, and one may visit many large gardens and not find even the old Lilies which are still grown by cottagers.

This neglect of Lily culture arises, I think, not so much from want of appreciation as from want of knowledge of the wealth of beauty existing among Lilies. Another cause is probably due to the mistaken idea that, as in the case of Orchids, the less common Lilies are difficult to cultivate, and, without the care and attention of a specialist, produce disappointing results.

We who know Lilies, common and rare, are fully aware that there are some species that are woefully capricious and baffle our attempts in growing them well, even after a long experience.

But we also know that a large proportion of them can be grown in

these islands in every garden where the difficulties of soil and climate are not insuperable, if we place them under conditions which we from experience know they require.

Of the sixty odd species now in cultivation in English gardens, there are at least half of that number of species, with their numerous varieties, that are perfectly hardy and may be cultivated to perfection in any favourable locality; for, though the various sections require diverse treatment, it is not a very difficult matter to place them under suitable conditions of soil and situation.

For cultural purposes it is best to divide the genus into groups that require different conditions of treatment in the matter of soil and situation, but these groups do not seem to run parallel with the botanical groups.

First, there is a group requiring full exposure, and a soil moderately rich and stiff in texture, such as sandy loam and leaf mould. The species that thrive under these conditions are such as:—

Batemanniæ	*dauricum*	*pulchellum*
bulbiferum	*elegans*	*pyrenaicum*
candidum	*excelsum*	*Szovitsianum*
chalcedonicum	*longiflorum*	*tenuifolium*
croceum	*pomponium*	*tigrinum*

The second group comprises those species that in the matter of soil require an addition of peat to the loam and leaf mould, and as regards exposure will succeed in a shadeless situation, though they seem to thrive best in a spot which is partially shady: that is, full sun only during morning or afternoon.

This includes species such as:—

auratum	*Leichtlini*
Browni	*Martagon* and its varieties
columbianum	*parvum*
Hansoni	*rubellum*
Humboldti	*speciosum* and its varieties
Krameri	*Washingtonianum*

The third group comprises those that revel in a deep sandy peat soil that is naturally moist but not sodden—a soil that in the driest days of summer seems moist and cool on the surface, and where the situation is partially shaded, such as the shadow cast over the spot during the hottest part of the day by large trees some distance away.

Among the species that thrive under these conditions are:—

canadense	*superbum*
Grayi	*Parryi*
pardalinum and its varieties	*giganteum*
Roezli	*Burbanki*

Such are the conditions, approximately, under which I have seen the species I have named flourishing best in gardens in various parts of the country; but from the close observations I have made during the past

twenty-five years of the behaviour of Lilies under culture, I am convinced that there can be no hard-and-fast rules laid down, as one frequently finds species thriving under peculiar conditions quite opposite to those I have stated.

For instance, I have seen the capricious *Humboldti* thriving perfectly in a sun-exposed hardy flower border in Lanarkshire, where the climate is moist with frequent cloudy skies. I recently saw *Szovitsianum* 6 to 8 feet high under the rather dense shade of Apple-trees; I have seen *candidum* and *croceum* also in shade flowering year after year; while at Kew one may see at the present time (July) the bulk of the Lily collection growing in full exposure to sun the whole day, and among them such shade-lovers as *superbum* and *pardalinum* growing and flowering magnificently.

The conditions, however, under which Lilies are grown at Kew, where frequent watering can be given, are not always attainable in private gardens, where water as well as labour is often scarce.

It is therefore the wisest plan to place Lilies under conditions in which they are likely to thrive with the minimum of care and attention.

Such conditions as I have mentioned can be found in most gardens, and particularly in those of large extent, where the exact spots suitable for each kind of Lily can be chosen and the soil made suitable for each group.

The gardens in localities where the soil is light are the most favourable for growing all the hardy Lilies with the least amount of preparation, and the heavy clay and chalk districts, I find, are the most difficult to deal with for Lilies, as in these districts peaty soil is rarely found in the neighbourhood.

The finest Lily gardens I know are those in the Heath and Pine districts, such as are found in Surrey and Hampshire, particularly on the southern slopes of the New Forest. In these localities one can often find, in the limited area of a small garden, high open spots where the soil is stiff, and low places where moisture collects, and where all the tribe of American Martagon Lilies grow to perfection without much trouble in the preparation of the soil.

I will name one particular garden in Hampshire, in the New Forest, where all the Japanese Lilies luxuriate. This is at Lord Manners' place at Avon Tyrrell, in the neighbourhood of Ringwood. Here *speciosum* planted among Kalmias and Azaleas and other shrubs on a southern slope grows as much as 4 and 5 feet high, and *auratum* much taller, and this has been the case for at least seven years, since the garden was made.

The soil is peaty and sandy, and being on a slope with high ground behind, there is sufficient under-moisture to keep the Lilies in full vigour.

In this case I attribute the exceptional growth to the partial shade that is given by a few of the smaller flowering trees such as Thorns, Amelanchiers, Pyruses, and such like, which cast a shadow at intervals over the Lilies; so that they are neither fully sun-exposed all day nor in continuous shade.

A noteworthy example of a Lily garden in the Pine district in Surrey is, of course, that of Mr. G. F. Wilson, F.R.S., who, as we all know, has been a devoted slave of the queenly Lily for nearly half a century.

His garden at Weybridge, with the Pines in it and about it, is known to many of us, as being the place where Lilies have been the chief objects of care and culture, and where experiments in their culture have been carried out for forty years. By the examples afforded in the garden, and by the published records of his experiments, Mr. Wilson has added immensely to our knowledge of Lilies and how best to grow them.

But it is in the garden at Wisley, a few miles from Weybridge, that Mr. Wilson has achieved the greatest success in Lily culture. This garden, a little more than twenty years ago, was simply a small wood, chiefly of oak trees in the low-lying part, and with open fields sloping with a northern exposure to the wood. The soil in the wood was, as one may suppose from the growth of oaks, of a stiffish nature, but with a good depth of accumulated leaf soil from the trees. The soil of the slopes was of a light sandy loamy nature.

The wood was naturally moist, too moist, in fact, in some places, so ditches were cut to carry off the excess of water, and this simple draining was all that the wood required to make it suitable for Lilies.

Then Mr. Wilson began to plant Lilies of all kinds in all possible conditions of shade and exposure, in dry soil and wet soil, and in various kinds of soil, the result being, as one sees to-day, marvellous, for now, after of course many failures in certain cases, Lilies of all kinds, common and rare, are growing under the conditions apparently most suitable for their requirements. The Wisley garden is an object lesson in what may be done by patience and devoted care and attention to details, and having known the garden from its commencement, and visited it many times, I have derived from it most of the hints I am giving in Lily culture.

During the past month (July) I visited it, and saw masses of Lilies growing in native luxuriance. *Szovitsianum*, 8 feet high, under Apple-trees, *superbum* in the partial shade, 7 and 8 feet high, and the same with *pardalinum*, *Humboldti*, *dalmaticum*, *giganteum*, *auratum*, and a host of others, including the fastidious *Krameri*, which was 4 feet high, growing under the dense shade of *Magnolia acuminata*.

Here is a garden delightful in every way, founded and ordered by a master in the art of Lily culture, and though we cannot expect to find frequently such exceptional gardens, there is no reason why such a Lily garden in localities where the natural conditions are at all suitable should not be enjoyed.

A woodland Lily garden is one of the most delightful phases of gardening, for there Lilies gain so much in beauty and graceful effect in association with tree growth, and appear more as they are in nature than elsewhere, as for the most part Lilies are woodland plants, loving the partial shade and the shelter afforded them during their tender stages of growth.

An ideal spot for a Lily garden is to be found in most large places and often in small ones. Sometimes it is an open clearing, natural or made, in a wood where, though sheltered from cold winds, the place is airy and admits sun all about it. Sometimes one finds an open glade with a rill running through it. That, again, is another place, especially where the moisture-lovers will flourish and gain much in beauty by a background of foliage.

In planting a woodland with Lilies close consideration must be given to the particular spots suitable for the various kinds, and especially to avoid planting Lilies where the roots of a hungry tree will quickly absorb all nutriment and moisture from the Lily beds. But there should be open places for Lilies at some distance from the trees, where their shade would be cast on the Lilies, if they require it, during some part of the day.

Fully-exposed spots can generally be found in the vicinity of the woodland Lily garden for those Lilies that require a shadeless position, and if the place selected is a slope facing south or west, with a background of trees to the north and east, such would be the precise spot for those kinds mentioned in the first group that require an open situation and a stiffish soil.

Though a Lily garden in and about a wood or coppice is the place where Lilies flourish and present their fullest beauty in combination with tree and shrub foliage, I do not mean to infer that only under such conditions can they be grown well; but what I wish to convey is the fact that one can grow, under those conditions, the largest number of kinds with the minimum amount of attention.

Lilies for Borders.

Now a few remarks on Lilies in the open border away from the shade of trees. We all know that there are several kinds that one can grow in the ordinary hardy flower border, and they mix in a charming way with other flowers.

The most prominent of these are *candidum*, *croceum*, *chalcedonicum*, *excelsum* or *testaceum*, *elegans*, *tigrinum*, *pomponium*, *pyrenaicum*, *Szovitsianum*, *dauricum*, *longiflorum*, and even the Martagons and *speciosum*.

These I have seen perfectly grown in what is called an ordinary border of common garden soil, with, perhaps, some better kind of soil placed about their bulbs at planting time.

Most of the Lilies named are strong growers, and will continue satisfactory if they are occasionally lifted and replanted in a fresh spot in the border.

The worst place for Lilies is the margin of an ordinary shrubbery, planted near to hungry, large-growing shrubs, which absorb all nutriment and moisture from the surrounding soil.

In catalogues one sometimes finds it mentioned that such-and-such a Lily is suitable for shrubbery margins, and this is interpreted generally to mean the spaces between such as Laurels, Lilacs, and so forth, the result being failure and disappointment.

Another phase of Lily culture, though not so nature-like as woodland culture, is that of growing Lilies in the open in masses in association with various kinds of dwarf shrubs, to serve as a shelter during the early stages of growth and as a foil or groundwork for the Lilies when in flower.

This is a beautiful way of growing Lilies, and one that is particularly suitable for large gardens and public parks, where the effect of large masses of colour is so desirable.

I mentioned just now that the bulk of the Lily collection at Kew is cultivated in this way, chiefly in the large sunk terrace garden on the west of the Palm House and its surroundings.

It is surprising to find what a large number of species is represented as grown in this way with more or less successful results, the more remarkable because at one time, twenty-five years ago, very few species could be grown successfully at Kew.

There are now at least twenty species grown in the open among masses of shrubs, and I could not point to a more instructive object-lesson than this Kew collection, which at the present moment (July) is at its best and open to all to study.

Some of the groups are exceptionally fine, and particularly the American Turk's-cap Lilies and the Japanese *auratum*, *speciosum*, and *japonicum* sections. One may see *auratum*, particularly the *platyphyllum* variety, 8 feet high and with stems an inch in diameter; *pardalinum* rising out of the Rhododendrons 6–7 feet high or taller; and equally fine are *superbum*, *Szovitsianum*, *Hansoni*, and others.

Opinions may vary as to the effect of Lilies rising with their flower-heads out of shrub undergrowth, but all will agree that under these conditions a large number of Lilies succeed perfectly, and produce a grand effect of colour at flower time.

For my own part, I think that such Lilies as *pardalinum*, *superbum*, *dalmaticum*, and other tall-growing kinds lose much of their graceful habit of growth if only the upper parts of their stems are free above the shrubs. I like to see them in a sheltered spot where their elegant swaying stems can be seen free, giving an additional charm to the flowers.

In growing Lilies in the open like this an undergrowth of shrubs is essential in order to give protection to the tender shoots in spring and early summer, when icy-cold winds sometimes ruin them for the season. It therefore seems to me the wisest plan is to choose the right kind of shrub as an undergrowth, which will thrive in the same soil as the particular Lily it shelters, and yet not grow so dense or tall as to overpower it.

The common practice is to plant peat-loving Lilies among Rhododendrons. This is generally satisfactory up to the time when the Rhododendrons close in upon the Lilies and smother them, for though the Lilies like the shelter they resent the heavy shade.

I gathered from Mr. Wilson the other day that he has come to the conclusion, after years of experience, that it is unwise to plant Lilies among Rhododendrons on this account, because at the outset the Rhododendrons must be planted tolerably thick to give effectual shelter, but with Lilies that are likely to remain undisturbed for some years the Rhododendrons overpower them, and one has to lift both Rhododendrons and Lilies and replant at wider intervals. He favours for peat-loving Lilies such dwarfer and slower-growing shrubs as Azaleas, Andromedas, Kalmias, Vacciniums, Pernettyas, and Heaths, all of which give protection to the young shoots in their early stage and make beautiful masses out of which the Lilies rise.

It is an easy matter to find suitable peat-loving shrubs to associate

with peat Lilies, but it is not such a simple matter to select suitable shrubs for the loam-loving or stiffer-soil Lilies, as the tendency is for these shrubs to grow tall quickly and overpower the Lilies. But by selecting those shrubs that naturally keep dwarf, and also produce a beautiful mass of flowers either at the same time as the Lilies or before them, one can depend upon delightful effects, whether as isolated masses in an informally planted garden, large or small, or on large beds in the extensive terrace gardens one sees about mansions.

Now that the prevalent tendency is to lessen the cost of maintenance of large terrace gardens by reducing to a minimum the "bedding-out" style, this plan of massing beautiful dwarf flowering shrubs with Lilies rising out of them to break the flatness of the masses is a style to be advocated, as the planting is more or less of a permanent nature.

In selecting suitable shrubs as undergrowth, the chief point to consider beyond those just mentioned is the harmony of colour between the flowering shrub and the Lily if they flower at the same time, and specially to avoid the clashing of colours of the shrub with the Lilies.

I will give a few examples of what I think are suitable shrubs for particular kinds of Lilies planted in this way and flowering at the same time:—

Ceanothus 'Marie Simon' or Lavender for *Lilium croceum*.

Rosemary or *Spiræa* 'Anthony Waterer' for *L. candidum*.

A Dwarf White Rose, such as 'White Fairy,' for *L. chalcedonicum*, followed by *L. Batemanniæ*.

White *Weigela* or *Osmanthus* for *L. tigrinum*.

Philadelphus Lemoinei for *L. Szovitsianum*.

Olearia Haasti and *Ceanothus* 'Gloire de Versailles' for *L. Henryi*.

For peat-loving Lilies the following shrubs and Lilies associate well, but in this case the shrubs are out of flower before the Lilies begin to bloom, so that two distinct colour effects are produced in succession:—

Azalea amœna, or *Rhododendron ferrugineum*, *myrtifolium*, or *hirsutum*, for *L. speciosum*.

Menziesia polifolia (Irish Heath) for *L. longiflorum*.

Zenobia speciosa for *L. Hansoni*.

Kalmia glauca for *L. Brownii* and others of that class.

Azaleas of the American or Ghent race for the tall Lilies like *L. pardalinum*, *L. superbum*, *L. Humboldti*.

Andromeda japonica, *Itea virginica*, or *Escallonia Philippiana*, for such as the Martagons, including the dark *dalmaticum* and the white Martagon.

These are only a few of the many combinations one may have. Others will readily occur to those who know the habits of the Lilies they have to deal with.

LILIES.

By J. Carrington Ley, M.A.

When the Secretary of the R.H.S. was so good as to ask me to contribute a paper in connection with the coming Conference on Lilies, I was not without apprehension that anything I had to say might seem too pessimistic for what, let us hope, is likely to be the cheerful optimism of such a meeting. I reflected, however, that while the "horrid example" is still supposed to be of use in certain circles, Cassandra, by a merciful provision of Nature, has never succeeded in gaining much attention, and that the cakes and ale are likely to go on in spite of my virtuously becoming a total abstainer from many species on which I have formerly spent money. The object of such a Conference is, of course, to ascertain by comparison and discussion what results may be aimed at with a fair prospect of success, and achieved under given circumstances; and if the result should be to enable any individual gardener to permanently establish one more Lily in his collection, that object will be attained.

With the exception of some of the Indian and Burmese species, Lilies pass, at any rate in the catalogues, as "hardy flowers," and it seems likely that there are parts or spots in these islands where at any rate it is not the degree of latitude which is the direct efficient cause of failure. For this reason we are perpetually concerned with questions of soils and aspects, protection and exposure; but in the discussion of the whole question of the cultivation of Lilies it may be as well to bear in mind that the bulbs of more of the species than we at present recognise may share the tendency of *L. giganteum* and some of the species of *Fritillaria*, and be unable to produce more than one flower-spike—the bulbs breaking up after flowering, and taking a long time, even under the favourable conditions of their own habitats, to again grow into flowering size.

I live myself in Mid-Kent, on the side of the central hills known as the Ragstone Range, and at a spot where they slope almost due north to the banks of the Medway, which intersects them, and I have come to the conclusion, after a residence here of close upon twenty-five years, that my garden presents every condition that is most unfavourable to the cultivation of Lilies. It slopes, as I have said, due north, there are no walls that give protection to any part of the flower garden, it gets the maximum of the N.E. wind, of which the Eastern Counties have more than their share, and the minimum of the winter and spring sun. The soil is a stiff, heavy loam, which is understood to grow the best hops in Mid-Kent, and which would grow excellent roses if I had a little more room and the inclination to go in for exhibiting; but it is as cold as it well can be during winter and spring, while in summer it bakes into the consistency of a brickbat, and I have no natural and no adequate or ready means of affording moisture during the summer months. Added to this, the garden is overfull, and I am disposed to think that the tendency to dwindle and die out which I notice in some of my Lilies, which formerly seemed to do

well enough, may be accounted for by exhaustion of the soil. The subsoil is what locally we call "the Rag," but which, for reasons best known to themselves, the geologists denominate "the Lower Greensand." I can only say I wish that more of the latter ingredient were perceptible in its composition. I append at the end of these notes two lists of Lilies: A, those that I grow or may be growing here with more or less success; and B, those that I regard as quite hopeless. There are several others, more or less rare or obscure, which I have tried from time to time without results, and which are not enumerated.

It only remains to add a few notes on the behaviour of some of the species mentioned.

Of the Isolirions, *L. croceum* and *L. bulbiferum* do well anywhere with good treatment, the latter maintaining itself by bulbils which are shed about. The hybrid *L. dauricum* or *umbellatum* (for it seems doubtful whether these are or are not identical) lives, but certainly does not flourish as it does in some gardens. *L. Thunbergianum* always dies, a result which I ascribe entirely to the coldness of the soil and aspect. If I lived on "the *Upper* Greensand" I could keep this. (Fig. 187.)

Of the Eulirions, *L. candidum* does well in every part of the garden, and I know nothing of the "disease" which seems to trouble many gardeners in the cultivation of this species. *L. longiflorum* is not hardy here generally, but as one bulb accidentally planted in a warmer situation has survived for two or three years I could possibly make it so. *L. Brownii* disappeared after flowering once or twice. This is one of the most beautiful Lilies in cultivation, and I think possibly that should I enlarge my garden, and give it some protection by means of walls (as I contemplate doing), I may still succeed with this Lily by giving it an artificial soil.

L. Parryi—one of the most beautiful of all the American Lilies—is coming up strong for the third year in succession. I give this what moisture I can (short of planting it absolutely in an artificial bog), which is not much, and it does very fairly, and certainly much better than I had anticipated. (Fig. 185.)

Of the Martagons, the common *L. Martagon* will no doubt do well in any good soil, but the white variety and the dark *L. M. dalmaticum* always die out here after a year or two. I am disposed to ascribe this to the coldness of the soil. A mile or two away from my garden I see both varieties doing well. *L. chalcedonicum* now does well here with ordinary cultivation, but the scarlet *L. pomponium*, though I kept it for many years, has disappeared, and I have never replaced it. *L. Hansoni*—one of the most distinct Lilies we have—does well everywhere here. It seems, indeed, to increase with such rapidity that the bulbs get too much jammed together, and cease to flower in consequence. This necessitates a somewhat frequent division, and this, like almost all Martagons, it resents for the first year of replanting by not blooming. *L. colchicum* (or *Szovitsianum*) is, in my judgment, the finest Lily in cultivation: at any rate, that is fairly available for all gardens. I have grown these here ever since I can remember, and have had them very fairly fine, but of late years they have dwindled, and though I have put in a few new ones, these have not done so well. I attribute this partly to the

cold aspect, but partly also to the fact that the beds in which they are grown are too full and the soil is probably exhausted. With new bulbs and a total change of position I could probably succeed as well as formerly; and the same remark applies to *L. tigrinum*, a Lily which formerly flourished and seeded about here, but which also seems to be dying out. This is a very late year, but on the day on which I write (April 7) neither of these Lilies has attempted to come through the ground, and I think it highly probable that they are all dead. *L. excelsum* (or *testaceum*) is an excellent Lily in every way, distinct in colour and easy to grow, but this, too, repays good culture, which at present it does not get here. (Fig. 199.)

The finest and most vigorous Lily I have at present is *L. Henryi* (the orange *speciosum*, as it is sometime called, though I suppose its botanical affinities are nearer *L. tigrinum*). I think this is the best investment in the way of a Lily I ever made. I bought it four years ago, and this year I see it is throwing up five blooming spikes. I know no Lily worth having with a constitution like this. (Fig. 180.) *L. pardalinum* maintains a doubtful existence. I do not expect to see it come up this year. I have made special beds for this, and have had it in bloom, but I attribute its tendency to fail to the want of sufficient moisture during the summer. *L. canadense* is an absolute failure, and so is *L. superbum*, both in peat and in an artificial bog. In the latter position the lime in the water is probably fatal to it. It is remarkable that *L. Parryi*, which has by no means a reputation for being easy to cultivate, has proved perhaps the most successful of any of the American Lilies with me. Others, such as *L. Humboldti* and *L. Washingtonianum*, I have found hopeless, though both are extremely desirable. Of the former there is a new variety called '*magnificum*,' which, according to Mr. Carl Purdy, who introduced it, is not only finer but more reliable in bloom, and possibly easier to cultivate.

L. speciosum is not hardy here if left out, while the *auratum* Lily (and all its varieties) is, of course, no use beyond the year after it is planted.

In conclusion, I think the best advice I can give readers of this JOURNAL who are interested in Lily cultivation is, not to be too much encouraged by the optimism of the makers of catalogues, nor depressed by the pessimism of a croaker like myself. On the one hand, it is quite certain that the "likes a little peat," or "grows freely in any ordinary border," which form the staple of a nurseryman's advice gratis, are by no means the be-all and end-all of Lily cultivation; on the other hand, there are plenty of gardens where the soils are light and warm, or where the aspect is warmer, and there is more command of moisture in summer, where several of the species which I am forced to regard as hopeless might be cultivated with every prospect of success.

According to Wordsworth,

> The wiser mind
> Mourns less for what life takes away
> Than what it leaves behind;

but the gardener's mind is, I fear, often disposed to mourn and grumble more about what he loses or cannot grow than to be satisfied with what

he can keep. It is noticeable that in this cold garden another liliaceous genus (the *Eremurus*, in three species) seeds by the hundred annually, and grows into blooming plants in about four years.

A	B
L. *bulbiferum.*	L. *Batemani.*
L. *candidum.*	L. *Brownii.*
L. *chalcedonicum.*	L. *Martagon album.*
L. *colchicum.*	L. *M. dalmaticum.*
L. *croceum.*	L. *longiflorum.*
L. *dauricum.*	L. *pardalinum.*
L. *Hansoni.*	L. *canadense.*
L. *Henryi.*	L. *Humboldti.*
L. *Martagon* (type).	L. *Washingtonianum.*
L. *pyrenaicum.*	L. *auratum,* &c.
L. *testaceum.*	
L. *tigrinum.*	
L. *Parryi.*	

LILIUM SPECIOSUM.

LILIES AT YALDING, IN KENT.

By Captain SAVILE REID.

THE following notes do not pretend to contain anything new or of scientific value in the study of Lilies, but I venture, nevertheless, to hope that a few practical remarks on my failures and successes in growing these glorious flowers here may prove of some use to those who, like myself, have fallen victims to their charms.

I have always loved a Lily. My earliest remembrance of its fascination dates back to my childhood, when the unexpected sight of a fine *auratum* in bloom in a pot in the conservatory at home nearly took my breath away. I had never seen anything so beautiful before, and made up my mind that when I was big and rich I would have a conservatory full of *L. auratum* in bloom all the year round, so that I could always be smelling and admiring them, regardless of the yellow pollen on my nose! In these days of "cold storage" of bulbs my childish desires might indeed have been realised, if only the riches had increased with the years. But it is the out-door culture of Lilies that now monopolises my more modest aspirations, and as I feel sure that there are many Lily-growers who are striving to beautify their gardens and shrubberies with these flowers, independently of their conservatories and greenhouses, I am emboldened to call their attention to a few species with which I have had experience.

To begin with the commonest, yet perhaps the most beautiful of all, *L. candidum*, the "Madonna" Lily—I found my Kentish garden six years ago well stocked with this Lily, in clumps alongside a grass border, and they did well and flowered satisfactorily for two or three summers. Then came the horrible, and to me at that time unknown, Lily "disease," a foul fungus that shrivelled up the whole plant slowly and surely, from bottom to top, just as the flowers were showing. All my clumps suffered, and I knew not what to do. I tried watering with soot and lime-water, and many other remedies, in vain.

Fortunately, I read in one of the gardening papers at that time a letter from a gentleman at Midhurst—I think he was the head master of the Grammar School there—detailing his experiences and suggesting a remedy for the disease.

So in the autumn, perhaps a little late, for the first crop of leaves had made its appearance, I set to work (rather doubtfully, I admit) and dug up all my bulbs, some 250 in number. They were laid carefully on the floor of an empty vinery, and as fast as the gardener and myself could deal with them were operated on and replanted in fresh places. The treatment was simple enough: about a dozen bulbs were put into a linen bag with flowers of sulphur, and gently shaken for a few minutes horizontally, till they looked like yellow balls of sulphur. All were replanted within forty-eight hours, except one poor unfortunate batch of a dozen, which somehow escaped notice, and were left in the linen bag hanging up

in the hot dry stoke-hole for a month, or perhaps six weeks. I regret that no actual dates were noted down, for the subsequent history of these bulbs is somewhat interesting. When at length (say a month later) the gardener told me what had happened, I smiled a bitter smile and was going to throw the bulbs to the pigs; but, having a spare corner suitable for them, I decided to plant them and see what became of them. They actually grew stronger and flowered better than their brethren, producing seven spikes of flowers between them, while the more carefully-treated clumps had in no case more than two spikes each.

This extraordinary result may give us a clue to the future treatment of the disease.

As I have just said, I only got a maximum of two spikes from the sulphured clumps, each of about twelve bulbs, the following summer (1900); but this year (1901) the thing is very different, and as I now write the numerous tall spikes of chaste flowers are delightful to behold. I should say the average is quite seven stems to every twelve bulbs, some of the heads containing fifteen flowers, while the foliage looks healthy and free from any taint.

I hope for still better results in 1902—that is, of course, if the snake proves to be killed and not merely "scotched."

I have striven hard to win, or rather retain, the affections of my first love, *L. auratum* (variety *platyphyllum*), but to me she is "uncertain, coy, and hard to please," like the rest of her fair sisters. At present, however, I have a few bulbs planted four years ago, the survivors of about double their number, which are going to flower this summer fairly well. These are planted in the rich loamy soil of my garden, mixed with about half its bulk of peat and sand, and they are on the warm side of evergreen trees, though they get little sun till after midday. But they flowered better last summer, I think, and they get smaller in spite of my care, so I fear they are going back. My best two spikes, under the lee of a very compact "hedgehog" holly in the same place, are from bulbs planted three years ago; these look admirably strong and healthy, but I suppose they will deteriorate and prove as disappointing as the others. One fact seems to hold out a hope, and that is the appearance this summer of offsets on the four-year-olds, which are bearing a few flower-buds. One of these elderly bulbs, after flowering splendidly in 1899, disdained to appear at all in 1900, but this year sent up a sturdy stem in defiance of all rules and regulations for the proper behaviour of Lilies. I thought it had gone the usual way of *auratum*, and had put in a variegated Tree Mallow in its place, missing the bulb by an inch or two with my spade, as I found out afterwards. But up came the spike defiantly, and out came the Tree Mallow in due course. The spike is a blind one, but very strong withal, and I look for something extra-special next summer after this long period of rest.

Should this be my reward, and a good head of flower appear in the fifth year, then, I think, my heart will begin to throb with joy, and I shall buy the ring, and ask the fair *platyphyllum* to name the happy day.

Meanwhile I shall not scruple to carry on violent flirtations with her lovely cousins and rivals, *Szovitsianum*, *Brownii*, *rubellum*, &c., just to show my thorough freedom and independence.

A gardening friend and neighbour of mine, Mr. Herbert Green, of Tovil, near Maidstone, has succeeded well with the ordinary form of *L. auratum*. (Fig. 206.)

He planted fifty bulbs in an exposed Rhododendron bed, in peat and sand, four years ago. They are all alive at the present day, which is a good deal to say, I think. Many continue to flower strongly and well,

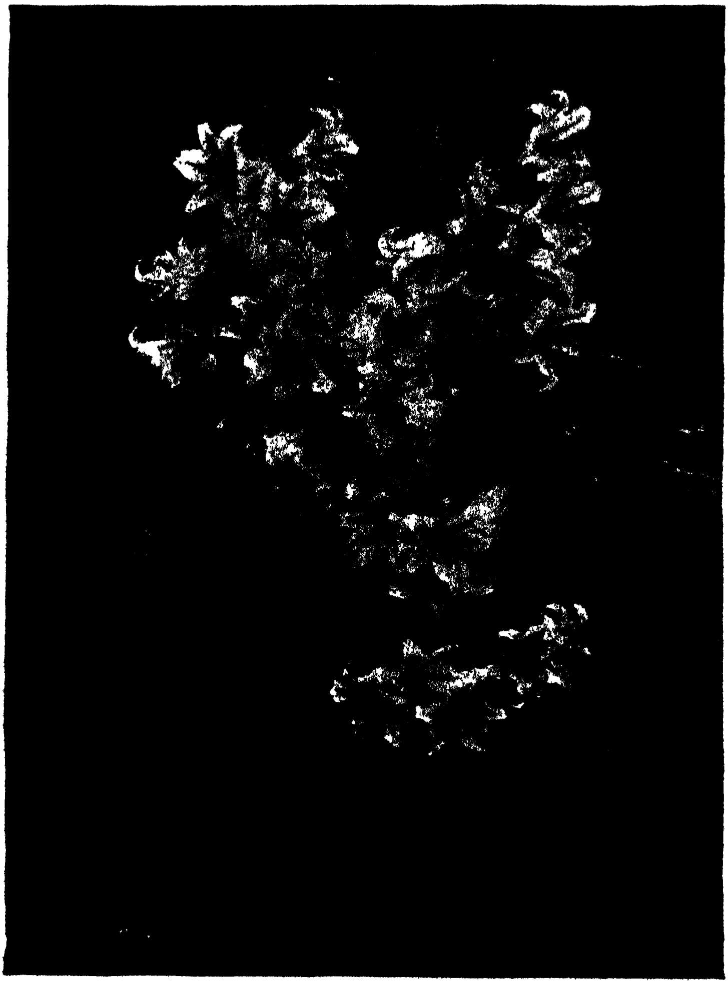


FIG. 206.—L. AURATUM.

others send up short spikes and flower feebly, but the hopeful part of it is that there are many offsets, though at present they have not flowered.

Three of my four-year-old offsets, as already mentioned, are flowering this year. Is there *really* a hope? Is Kent to prove *the* place for the establishment of *auratum*? I fear not. Not until a G. F. Wilson shall arise in the county!

Six bulbs of *Szovitsianum*, from Mr. Wallace, planted at the edge of

a clump of *Berberis aquifolia*, have been a grand sight this year—their third appearance. All six have flowered, and I have brought the last spike, a small one, to this Conference, as the blooms are very fine. The average height of the stems was 5 feet. There were fifteen flowers on one, the others having four to eight each. Mr. Wallace saw the group about a fortnight ago and much admired it. The soil is a mixture of loam, peat, and sand; the site is exposed to every possible ray of sunshine up to 8 P.M. The spikes push their way up through the outer branches of the *Berberis* at first, but when the flowers appear I cut back the *Berberis* and expose the clump to the full glare of the sun. I do not know if this is a good thing or not.

Szovitsianum is a beautiful and desirable Lily, worth any amount of trouble, though the scent is a little too powerful and peculiar for some people. I am trying some bulbs in another spot, where they get only the afternoon sun, but they are too recently planted to warrant any remarks on their behaviour.

The dwarf and exquisite *rubellum* is another favourite of mine. I have but three bulbs and cannot say I have done much with them so far, but I hope I have at last got the right situation for them, thanks to a letter in *The Garden*, from Mr. Barr, some time since, describing their natural growth in their native country, Japan. In consequence of this letter I moved mine from the Rhododendron bed, where they were doing but poorly, to a dry bank under a greedy and aggressive Lilac-bush, where they get morning sun only. Here, planted last year in light soil, with plenty of stones and broken bricks, they so far recovered from their move as to send up their delicate spikes, one of which produced two flowers and another one flower only, the third being a blank. (Fig. 192.)

This was not much to boast of, certainly, but the flowers were of the most intensely beautiful pink, and now, long after they are over, the foliage is as fresh and green as ever. I shall anxiously await next year's developments, for we have no Lily like this, so dwarf and so delicate in tint.

Burbanki I have mentioned on one or two occasions in *The Garden* as being a highly promising Lily.

Two bulbs from Mr. Wallace gave me a few good flowers last summer, but now they have sent up no fewer than six spikes between them, with an average of six flowers each—altogether a very creditable performance. They are in a Rhododendron bed in peaty soil, where they are rather dry and dependent on artificial watering, though they do not seem to require much.

This is a very satisfactory Lily, apparently, though I have not yet heard of anything in the way of bloom in this country to equal the marvellous show it seems to afford in America. I have brought a spike to this Conference which will give a good idea of its foliage and flower.

With several other Lilies I have done fairly well, and with some others have utterly failed, so far. Concerning these I have no remarks to make of any value, I fear.

The only one I would mention is *L. Brownii*, a very handsome Lily indeed, which flourishes here on the dry slope of a Rhododendron bed, where it gets hardly any sun till 2 P.M. It has been most satisfactory

for three years in succession, though I have never had more than two flowers on a stem. (Fig. 207.)

Lilies of the *speciosum*, *Thunbergianum*, and *tigrinum* groups do fairly well with me, so do *L. Henryi*, *L. croceum*, and *L. chalcedonicum*, but I cannot hit off the requirements of *longiflorum*, *Krameri*, *concolor* (fig. 208), and other desirable species. *L. Grayi* and *L. Batemanniæ* have made an excellent start this year, but it is too soon to consider them successful.

But I should like to detail my experiences with *L. Parryi*, as they may perhaps prove useful to those who grow or intend to grow this beautiful Lily. Though, comparatively speaking, an old Lily—introduced, I think, in 1879—it has not been extensively grown in this country for more than a few years, and the percentage of failures with it has been high. This, I take it, arises chiefly from a want of knowledge of its habits and surroundings in its native country, California. Purchasers have certainly been

FIG. 207.—L. BROWNII.

FIG. 208.—L. CONCOLOR.

under the impression hitherto that it is essentially a *bog* Lily, and as such entitled to a place in peaty and wet soil. I certainly thought so myself in 1898, when I joined Mr. Carrington Ley and two other friends in the purchase of some bulbs from Mr. Carl Purdy, of California, and it was by a most lucky fluke that I succeeded so well with my share. I have already written on this subject in *The Garden* of November 17, 1900, and June 8, 1901, but shall venture, at the risk of repeating myself, to give a brief account of my good fortune. My six bulbs were planted on arrival in my so-called peat-bog, a small bed adjoining a brick-cemented water-lily tank, from which a pipe was arranged to conduct the water into the bog at pleasure.

I planted them about six inches deep in a mixture of peat, loam, and sand, about eighteen inches in thickness, under this being a layer about twelve inches thick of stones, brickbats, broken bottles and other rubbish, the whole draining eventually into the overflow from the tank. No water was admitted during the winter subsequent to planting; the only protection given was a thin layer of cocoa-fibre intended merely to preserve *Primula rosea* and other dwarf plants in the bed from the designs of the early slugs.

The six spikes duly appeared in the spring of 1899 and were a source

of great anxiety. In the drought of spring I decided to let in the water from the pond, but the pipe was hopelessly choked and refused to act, and no water ever passed through it, then or subsequently. The six bulbs all flowered fairly well, one producing seven flowers, and I was happy. I left the choked pipe severely alone the next spring, 1900, the only watering ever vouchsafed being the limited ration doled out from the clouds in our part of Kent, and the occasional one or two big potfuls from the pond after the spikes were out of the ground. The 1900 bloom was something extraordinary. Six spikes, one of them from an offset only, gave a total of 105 perfect flowers, the actual numbers being 39 (probably an English record up to the present time), 24, 14, 13, 12, and 3.

I regret that the only photograph taken was insufficiently exposed and useless, but many friends came to see and smell and admire. (Fig. 185.)

The 39-flower spike was quite 7 feet high, the others a little shorter.

This year (1901), as I feared, the display has not been so brilliant. No fewer than twelve spikes came up, and all but one (a strong blind one) flowered, including the smaller offsets, so it is evidently a prolific Lily when comfortable. Eighty-seven flowers expanded, and the effect was again very pleasing, though the greatest number on one stem was only fourteen, and the stems were quite a foot shorter than last year. This time a photograph was kindly taken by a friend, and I hope it may duly appear in *The Garden* together with others of various Lilies doing well with me.

And now I come to the crux of the whole matter, and I say that the reason of my success is not far to seek, now that we learn from Mr. Carl Purdy that *Parryi* is not a bog Lily after all—only, apparently, a lover of well-drained beds of suitable soil in the vicinity of mountain streams.

Mr. Wallace, who paid me a visit lately and was much interested in my Lilies, knows more about *Parryi* than most of us, and he will have told you, probably, the history of his various plantings. And we shall have learnt better how to grow it in future, I trust, and lose no more in the uncongenial wet peat originally devoted to it. I dare not suggest that my proceedings should be imitated. I cannot say, "Put a pipe from your pond into the peat-bed, plant your *Parryi* bulbs, stop up the pipe scientifically so that no water can pass through it, and there you are!" But it seems that thorough drainage and the vicinity of water are the two essentials; if there are other important ones I am unable in my ignorance to detect them, though I might perhaps add as a factor in my success the comparative dryness of the peat-bed in winter, for no artificial watering has been given till the spikes first appeared. The proximity of the bulbs to the walls of the tank, which is always full of water, may, of course, ensure the presence of a certain amount of necessary moisture; at any rate it keeps the bulb cool at all times.

I will conclude these rather rambling notes with the expression of the hope that they may contain something to interest if not to instruct, the numerous Lily-growers of the R.H.S.

LILIES IN DEVONSHIRE.

By G. S. PATEY.

IN reply to the Secretary's request I am pleased to give my small experience in the growth of Lilies.

I am favourably situated in South Devon, within six miles of the coast, and consequently suffer less from cold than those residing in more inland districts. In addition, my small garden has nearly six feet of good red loam, and within five hundred yards I can obtain the best fibrous peat it is possible to wish for. My collection numbers many species, but all in small quantities, saving a few sorts. This season, owing to the extreme drought, they are not their usual height, in spite of watering, which does not damp the atmosphere. My first Lilies to open this year were

FIG. 209.—L. SUPERBUM. (Showing habit.)

FIG. 210.—L. POMPONIUM.

Szovitsianum and *pyrenaicum* (June 1), both growing strongly in loam mixed with limestone road-scrapings, which I find most beneficial. *L. rubellum* was the next, in height 15 inches, growing in two-thirds of road-scrapings. This Lily with me evidently likes a poor soil, and is now growing the second season. All the forms of *auratum* are uncertain with me, except *platyphyllum*, which is now over 6 feet high, with magnificent foliage and about thirty bloom-buds. These grow in peat among Rhododendrons. In the same border I have *nepalense*, blooming the fourth year, 6 feet, with seven buds. Last season it was 7 feet. I believe it is not common to find this Lily doing so well out of doors. *L. Parryi* is 8 feet, with seven buds, in peat, together with the following species: *Grayi*, *giganteum*, *Henryi*, *japonicum Colchesteri*, *pardalinum*, *superbum* (fig. 209), and several forms of *speciosum*, as *Melpomene*, *roseum superbum*, and *Krætzeri*, averaging 4 feet and increasing in number. In the shadier side of my garden (a necessary situation with me for their successful growth), planted in the natural loam with the addition of sand round the bulbs, and with the more tender forms a few nodules of peat, I

have *L. dalmaticum* doing very well, and 4 feet in height. *L. Martagon album*, having been replanted last season, I see is not nearly so strong as on other occasions. A dwarfer form and quite distinct, given me by Mr. Archer Hind, is, I believe, not generally known, rarely reaching 3 feet, but it is lighter and more graceful. *L. dalmaticum Catani* does very well, and is, I think, more velvety than the ordinary form. *Chalcedonicum* is always satisfactory, looking strong and healthy, a much better doer than its neighbour, *pomponium verum* (fig. 210). *L. Brownii* is growing strongly, and promising to bloom later on. *Batemanniæ* is very satisfactory (fig. 211). *Concolor*, a gem, is now open and is very distinct and dwarf.

Among the better-known forms I have *candidum* (free, I am thankful to say, from disease), *croceum*, *dauricum*, *excelsum* (syn.

FIG. 211.—L. BATEMANNIÆ.

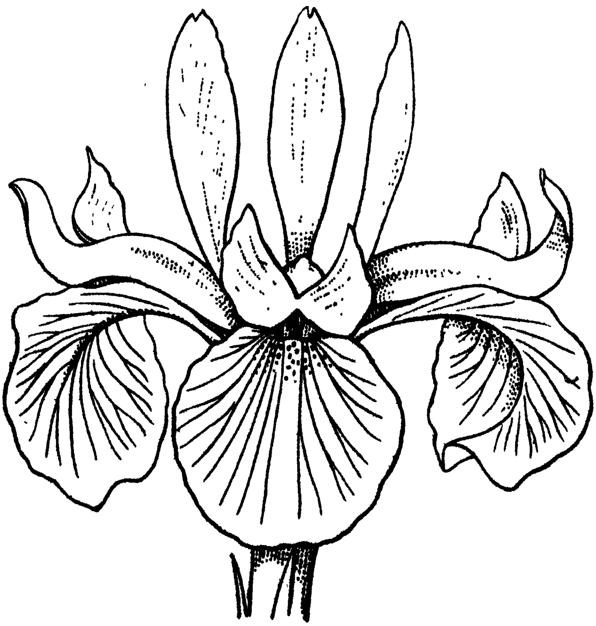
testaceum), *Hansoni* (just open), *polyphyllum*, blooming the first time, but only two flowers, the bulbs not yet being sufficiently strong to grow finer spikes. This Lily is in a very moist place, and evidently likes it. *Humboldtii* and *H. magnificum* are doing fairly well in sandy loam, but with me they have not the vigour I should wish to see. *Leichtlini* is much stronger, though not generally so. The new *Burbanki*, two stems planted in peat, has about forty buds, a great improvement on last year. *Rubescens* grows with me, but I have never yet seen its flower. *Sulphureum* is strong, but so late it is apt to be spoiled with autumn rains. In the Tiger section, *Fortunei* is very fine and increases rapidly; also *tigrinum splendens*. In addition I have some few varieties of *Thunbergianum*. 'Prince of Orange' has been charming, with its dwarf apricot-coloured flowers opening here before the other varieties. These Lilies are

better able to stand the full sun. *Wallacei*, a fine late bloomer, likes, on the other hand, shade, and is very beautiful, being so clear in colour, and increases freely. I have a few bulbs of *L. leucanthemum*, but last year they were not strong enough to bloom. This season I am looking forward to seeing the flowers. The species appears to have a capital constitution, and will, I expect, be of easy culture. *L. Krameri* I am not fortunate with, losing it after the first season, as is the case with many Auratums with a few exceptions. Also the varieties of *longiflorum* do not increase with me, rather splitting up into small bulbs.

I think, as I before mentioned, Lilies to grow well require a dripping season; the water-pot relieves the root, but does not affect the atmosphere surrounding them. This given, with a partial shade and the proper soil—a matter to be proved by practical experience—Lilies are of easy growth and of the greatest beauty.

In reference to the dwarf form of white Martagon, Mr. Archer Hind writes me he had it from an old clergyman on the banks of the Tweed more than fifty years ago. It is smaller in every way, and the leaves narrower; the stem also is entirely without the pubescence found in the ordinary white and purple forms.

ADDENDUM.—October, 1901.—My plants of *sulphureum* and *leucanthemum* both opened at precisely the same time, and as far as I and other Lily growers in this neighbourhood can see they are identical. We can discover no difference whatever unless it be in height—*sulphureum* was 6 feet high with seven blooms on it, and *leucanthemum* only about 4 feet; but then *sulphureum* was an old-established bulb and *leucanthemum* only in its second season. The leaves of both plants were identical, as also to us the blossoms.



EXPERIENCES IN GROWING LILIES.

By Dr. Bonavia, F.R.H.S.

First and foremost must be placed the lovely *Lilium candidum.* For this one Lily is unique; not only on account of the purity of its whiteness, and beautiful shape, but also on account of the ease with which it grows and flourishes, and the peculiarity which it alone possesses of throwing up winter leaves which are not destroyed by 10° of frost.

The soil of my garden is a stiffish one, but very porous. If a can of water is poured on it, in less than a minute the water disappears.

When I came here I found a few bulbs of the *L. candidum,* which I took up and replanted *at once.* They never hesitated in throwing up their winter foliage; they flourished, and flowered next summer.

A lady friend has a large number of them in her garden, and she finds no difficulty whatever in growing them.

Then I bought a dozen fine bulbs from a bulb merchant in London. As soon as I received them, I planted them on the outskirts of a Rhododendron bed in September. They all came up the first year and flowered; but now I have only five of these, and they do not appear very strong. The rest have disappeared.

Then I bought a hundred here which had been forced. Some of them came up weakly, and now I have, of that lot, only three weak ones left.

Those who have them and wish to replant them should not keep them out of the ground, even for an hour. The ground should be well dug, and manured with old manure—for this Lily is not afraid of manure—before taking them up; and then replant *at once.*

I think that many failures occur in growing Lilies, owing to their having been dried for exportation. The bulb may retain sufficient vigour to throw up a stem and flower the first year; but its constitution may have been injured by the drying process, and in many cases it does nothing afterwards.

I tried a large number of the Lilies on Wallace's list, and the following are the only ones that remain.

It should be noted that this year, with its long drought and cold easterly winds, has been very unfavourable to Lilies, excepting the *L. candidum,* for several are stunted, and in three or four cases wholly blind.

L. Hansoni.—Tall. Leaves in whorls; flowers pendulous, petals thick and bright yellow, spotted maroon.

This comes up every year, and does not appear to have suffered much from the drought.

L. pardalinum.—Leaves scattered, and flowers erect, orange-yellow, with deeper coloured centre, and spotted maroon. This year it is stunted and few-flowered.

L. Martagon.—Leaves in whorls; flowers pendulous in a long spike, maroon purple, centre colour of yellow ochre, and spotted maroon; the

surface of the petals is shiny, as if it were glazed. It has not suffered much from drought. [This is probably *dalmaticum*.—ED.]

L. Martagon album.—Leaves as above; flowers pendulous in a fine long spike, pure white with a green centre; has not suffered.

L. umbellatum erectum.—Flowers large, of an orange colour, with a yellowish centre and finely spotted maroon.

Of this I have two clumps which appear to be established, as they come up every year and multiply. These are among Rhododendrons. I planted another dozen last autumn in the same bed; some came up and others not, few have flowered. And yet another dozen in another place; most of these have come up and have flowered, others did not appear.

L. Henryi.—Leaves scattered, somewhat curled, and dark green; tall; flowers orange-yellow with green centre. (Fig. 180.)

This Lily does not seem to have suffered in any way. It is strong, and comes up every year and flowers.

L. excelsum.—Leaves scattered, upper ones short and narrow; flowers pendulous, and of uniform pale nankin colour. It comes up every year, but this season it is much stunted.

L. concolor.—Dwarf, with scattered slender foliage; flowers, pale yellow.

L. pomponium verum.—Dwarf, with scattered slender foliage and scarlet flowers, like those of *chalcedonicum.* This and *concolor* came up and flowered for two years. This year they both came up, but are quite blind.

L. speciosum Krætzeri.—Leaves scattered; flowers pure white. Has come up every year among Rhododendrons, but makes a rather feeble plant.

L. speciosum cruentum.—Leaves scattered; flowers suffused carmine and spotted deeper. Comes up every year among Rhododendrons, and appears to be established and strong.

L. speciosum punctatum I have in a pot under glass, but it makes a feeble plant, perhaps from indifferent management.

L. Alexandræ I have also in a pot under glass, but it again makes a feeble plant, perhaps from a similar cause to the preceding. (Fig. 212.)

L. chalcedonicum came up and flowered well for two years; this year it came up dwarf, about 8 inches high, and the poor thing is going to make an attempt to flower.

I have a few others which come up annually, but as I have lost their tickets it is not easy to identify them either from Wallace's Catalogue or from Nicholson; so I had better say nothing about them.

Among the failures I count the following:—

L. tigrinum.

L. tigrinum flore-pleno and *splendens* I have tried; they flowered the first year and never appeared again; of *tigrinum* I have collected a number of axillary bulbils, which now form a small bed in their third year, and some promise to flower. Perhaps they will become established.

A friend of mine, not far off from my garden, had a magnificent bed of *L. tigrinum* in prime condition. When in full flower it was a perfect sight.

L. Brownii.—Of this Lily I had a small bed; for two years the plants came up and flowered well. This year only one tiny stem made its appearance and is quite blind.

Fig. 212.—L. Alexandræ.

(To face page 412.)

L. auratum Wittii, rubro-vittatum, and *platyphyllum*.—These three Lilies came up for two years, but this year they have not appeared.

L. longiflorum Harrisii, and *longifl. foliis albo-marginatis*.—These Lilies came up the first year and flowered well; the second year they made a feeble attempt and some flowered; this year there are a few about 2 inches high!

L. giganteum.—Three years ago I planted a bulb of this Lily. It came up a few feet, and did not flower. Next year it sent up a stem about 8 feet high and flowered magnificently. Unwisely I made it seed. It produced three fine pods with an infinity of apparently sound seeds. I sowed them in pans, but owing to more or less unavoidable neglect and want of proper management they did not germinate. The mother plant perished outright, with an offset that had come up near it. The next season I planted two large bulbs of this same Lily, said to have been

FIG. 218.—L. KRAMERI.

imported from Holland. The one never came up, and the other only reached 8 feet without flowering, and this year it threw up a tiny offset which I think will perish. (Fig. 181.)

I think this Lily, under proper management, can be made to seed and leave innumerable progeny; moreover, I think it will cross with other Lilies.

L. Krameri—the pink Lily—came up feebly the first year and produced one flower. It never appeared again. (Fig. 218.)

L. rubellum I had in a pot under glass. It flowered fairly the first year, and feebly the second year; then it perished. (Fig. 192.)

L. nepalense I had in a pot under glass. It grew to about 7 feet high, its flowers being pale lemon and dark purple inside. The second year it threw up a tall stem, which perished before flowering. (Fig. 182.)

There are, I think, five circumstances in growing Lilies, each of which may interfere with success, viz.:—

(*a*) Constitution of the bulb at time of planting.
(*b*) Climate.
(*c*) Season.
(*d*) Soil; and above all
(*e*) Management.

If many of these bulbs were grown in suitable places in the South of England or Ireland, and sent to purchasers the same day they were taken up, probably they would not suffer much.

As it is, many of them come from foreign countries—Holland, Japan, and elsewhere. They have, therefore, to be dried and kept a long time out of the ground. When planted they may not come up, and if they do and flower they may not survive.

I know of no other way than to try them in different parts of the garden and hope for luck in their future. Should any become established, they should not be meddled with *in any way whatever.*

Not improbably some of my failures were due to want of proper management and knowledge of their requirements; and also to my having planted them too near some large old trees, the roots of which may have sucked up any moisture and nourishment available; but, curiously enough,

FIG. 214.—L. LONGIFLORUM.

others planted in the same locality, such as *Hansoni, Martagon, pardalinum, chalcedonicum,* and a few others, did not suffer apparently from those causes.

The soil which I consider best suited for most Lilies is that of old gardens, which has been worked and manured for years, and which has had a considerable proportion of leaf-mould mixed up with it.

Some Lilies can be easily grown and become established, others require a special study in order to get an insight into their wants and the places that may suit them. Even then, I think, a number of experiments will have to be made to achieve success.

Ignorance of the nature and wants of many Lilies, and of the localities which would suit them, will probably account for many failures.

For this there seems to be no remedy other than making repeated experiments with new sets under different circumstances and in different localities in the same garden. All this will require some expense and

trouble, but they are well worth undergoing, as most Lilies, if established, become a delight every season.

I think the nomenclature of Lilies might perhaps admit of some simplification. There are individuals among certain groups which may be mere varieties and not require specific names. Such may be the case in the groups of *L. auratum, longiflorum* (fig. 214), *Thunbergianum, tigrinum*, and many others.

Two Lilies—the one found in the Old World and the other in the New—may have somewhat different characters, but it does not follow therefore that their ancestors did *not* originally come from the same pod. It should not be forgotten that a dehiscing ripe pod in one place might possibly be caught by a cyclone, and its light-winged seeds sucked up in the upper regions of the atmosphere, and, like the dust of Krakatoa, eventually deposited hundreds of miles away, even across the Atlantic, If any of them germinated, and their descendants were discovered centuries afterwards, they would probably be given specific names.

The question then arises, Ought two closely-related Lilies to have different specific names simply because the one was discovered in Asia and the other in America, or elsewhere ? In such a case they would be mere varieties, owing to difference in the constitution of the seeds even of the same pod, and the climate and other conditions in which they had become naturalised.

AN AMATEUR'S ATTEMPT TO GROW LILIES ON CHALKY CLAY.

By Henry Jonas, F.R.H.S.

As I only planted *L. auratum*, *L. canadense flavum*, and *L. Brownii* in a shaded Rhododendron bed three years ago, my experience can be of little value, but I will briefly describe my surroundings, in hope that others with similar soil, &c., may be encouraged to try these lovely flowers.

My newly-made garden is 560 feet above sea, slopes gently to north-east, and is surrounded by old oak and other forest trees. I thus get perfect shelter from all winds, and but little sun. The top soil contains a

Fig. 215. - L. auratum.

good proportion of vegetable matter, being old woodland, and the dead roots no doubt assist in draining the subsoil, which is a pure red clay full of large flints, and rests upon the solid chalk, in places not more than 8 feet below. This clay on opening up breaks into large flat-sided cubes, is very unmanageable if worked in wet weather, but pulverises perfectly on exposure.

The first summer the three Lilies named grew 2 feet, 2 feet 6 inches and 3 feet in height, giving, each of them, three to five fine flowers; and these being the first I had seen flowering in the open air I straightway fell in love with them, and have since planted some 200 bulbs.

The second year the *L. auratum* had flat-sided fasciated stems, but

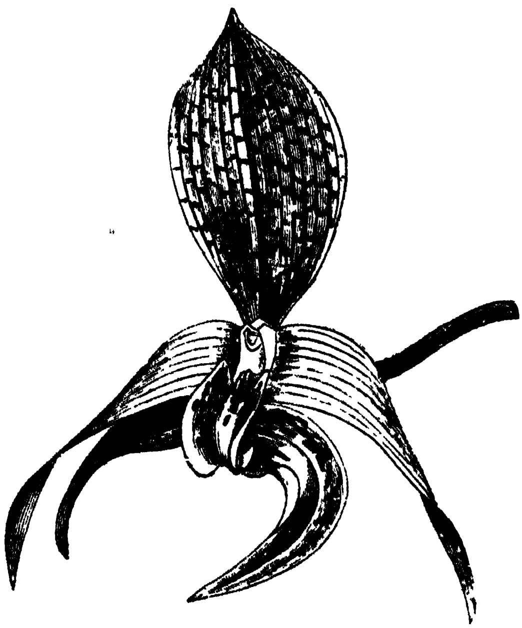
flowered fairly well, and the others gave rather more flowers than the previous year. (Fig. 215.)

This, the third year, the *L. auratum* are most vigorous, the stems 2 inches round and 5 feet to 7 feet 6 inches high, and one has borne twelve perfect flowers. All, including those planted last year, have rich shiny dark green leaves, and I have not a brown leaf on any Lily except where the stems or the bulbs have been injured by grubs.

I should add that last autumn I planted a variety of Lilies in prepared beds on clay banks rising at an angle of 1 in 2 feet horizontal. On the face of the clay bank I put a layer of flints, then turf with the green side downward, then 10 inches of pulverised clay mixed with peat and leaf mould, then 10 inches of the same with sand and grit instead of the pulverised clay.

I have also planted *L. auratum*, *L. a. rubro-vittatum*, *L. Brownii*, *L. Henryi*, and *L. speciosum* in open shrubbery borders on the fringe of a wood with only leaf mould and sand dug in; the former were eaten off by snails; the last two are very strong and healthy, but backward through late planting and too much shade, but they have given much finer blooms than those in the prepared beds.

Last year, reading that Lilies prefer to have their roots cool, I sank some agricultural drain-pipes (a foot long and 2 and 4 inches in diameter) about 10 inches vertically, in all the Lily beds, and I have watered freely through these pipes once a week this dry spring and summer, and so kept their basal roots cool without wetting the bulb; and I attribute their improved healthy appearance this year to this mode of watering, and hope others will give it a trial, as it saves both time and water.



LILY-CULTURE UNDER GLASS.

By R. W. Wallace, F.R.H.S.

Having only last year read a paper before the Royal Horticultural Society on Lilies in general,* I do not propose to take up much of your time to-day, but in these few notes to confine my remarks principally to the cultivation of the Lily under glass and the great use that may be made of it as a decorative greenhouse plant.

I will speak of those kinds first that are suitable for forcing, and may be subjected to considerable warmth during the spring, so as to have them in flower at an early date; and I would draw special attention to the following varieties, which are excellent subjects, but are very seldom used for this purpose.

For several years past I have grown under glass during the spring months a large number and variety of Lilies, with a view of having them in

Fig. 216.—L. tenuifolium.

flower by the end of May, and this has been a great guide to me, and helped to show what is possible in this direction.

It is understood, in speaking of the following, I am supposing that fine bulbs have been potted up in early autumn and plunged in a cold frame, and taken from thence into the warm house as required. The various forms of *L. umbellatum* and *L. Thunbergianum* are most satisfactory, responding quickly and readily to this treatment; their erect, bright showy flowers, borne in large umbels, massed on the ground and associated with foliaged plants, especially Japanese Maples, will be at once striking and effective. Funkias also are most useful plants in this respect, especially *F. Sieboldi* and *undulata variegata*. Of *L. umbellatum* I would recommend the varieties—*erectum*, 'Cloth of Gold,' *grandiflorum*, and *incomparabile*; of *L. Thunbergianum*—*atrosanguineum*, *alutaceum*, 'Prince of Orange,' *brevifolium*, and the new 'Orange Queen.'

Lilium tenuifolium (fig. 216) is a gem amongst miniature Lilies, and of the greatest possible use for early work. I have found it start very

* *R.H.S. Journal*, vol. xxv., p. 98.

quickly if given a little bottom heat when first brought into the house, and grow away with great vigour and freedom. I remember reading in an American paper some time ago a description of a large winter garden in which forced hardy plants had been used principally for the spring decoration; amongst other things was a mass of about 500 *L. tenuifolium,* carrying three to seven flowers each. This was described as a most unique and striking feature.

Lilium excelsum.—This is another very useful Lily, and may be had in flower any time from the middle of May. It responds to forcing in the same manner as *L. candidum.* The foliage is apt to suffer if too hard forcing takes place, otherwise it is perfectly satisfactory. (Fig. 199.)

FIG. 217.—L. DALHANSONI (HANSONI × DALMATICUM).

Lilium Hansoni.—A first-class pot Lily, growing freely, and may be had in flower from early May; very effective on account of its tall, graceful habit and fine flowers. Its descendants, *Dalhansoni* (fig. 217) and *Marhan,* both take after it in being equally suitable for this purpose.

Lilium rubellum.—This little gem makes a perfect pot-plant, and has done very well with us as such this last season; this I attribute principally to our having received finer bulbs from Japan than previously. Growers of this Lily must not be discouraged when it first shows above ground, as I know no Lily that looks so weakly when it first appears. Its flowers have a delicious fragrance, and last for some considerable time in perfection. (Fig. 192.)

Lilium Henryi, a grand pot Lily, should be started quite early in the year to have it in flower by the end of May. Three or four stems in a pot give a fine effect. The foliage is good and remains in fine condition a considerable time. The plant grows to a great height; this, perhaps, is against it, but its graceful habit must commend itself to all. As soon as the buds show colour, remove it to a shady position and the colour will be much deeper and richer. I think the colour of this Lily is better developed under glass than in the open. I should like to say here that, of all he Lilies introduced during the last twenty-five years, I think this must be accorded the

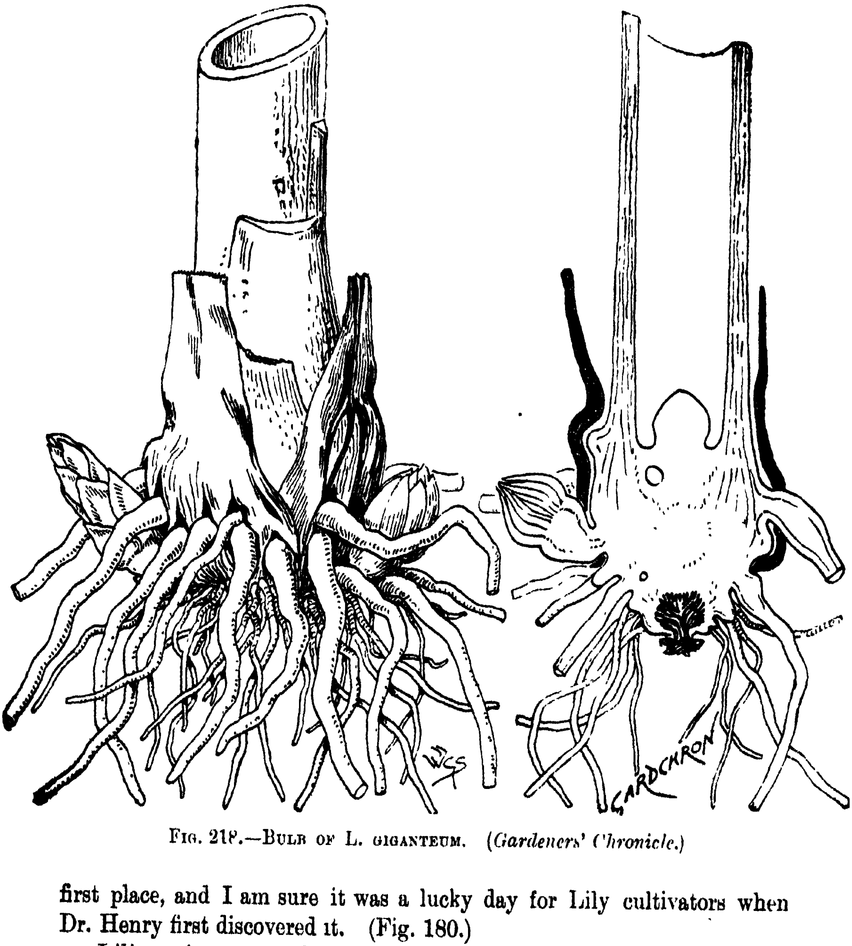


FIG. 218.—BULB OF L. GIGANTEUM. (*Gardeners' Chronicle.*)

first place, and I am sure it was a lucky day for Lily cultivators when Dr. Henry first discovered it. (Fig. 180.)

Lilium giganteum.—This noble Lily, when well grown, is very striking, but it requires careful treatment to have it in flower early; for if it has too much heat and excess of moisture the stems are apt to split, and, being hollow, this practically ruins the flower-spike. I would suggest that the bulbs (which differ somewhat from the bulbs of most other lilies, fig. 218) should be placed under glass in autumn, say in a cool vinery, and left to come along gradually.

Lilium odorum or *japonicum Colchesteri.*—This fine Lily, which was once so scarce, is now cultivated largely in Japan and sent over to

this country in quantity. It starts very quickly into growth, and grows rapidly. If allowed to open indoors, it comes a beautiful soft creamy yellow, without any external coloration; but if the plants are removed to cooler quarters when the buds are half developed and placed in full sun they will then take on the beautiful external brown coloration, which makes such a contrast and adds so much to the beauty of the flower. I find this coloration is produced best by placing the plants outside in a south frame and covering them with a light at night if cold. When in full growth, keep the plants on the shady side of the house.

Lilium Brownii should be treated in a similar manner, as this Lily loses all its beautiful character if opened in heat, the flowers coming

FIG. 219.—L. LONGIFLORUM WILSONI.

quite white. It may not be possible to have these two Lilies in flower in proper character by the end of May, but I have had them in perfect condition the first week in June.

Lilium longiflorum.—This is so well known that it seems needless to mention it, but I cannot pass over this beautiful Lily without a few words. The ease with which it may be grown, its cheapness, and its wondrous beauty make it essentially the Lily for greenhouse culture, and in addition all the above-mentioned varieties gain enormously in effect when grouped in connection with it. Had I to choose one Lily, it would be either *longiflorum* or *candidum*, and I fancy my choice would lie with the former, as I should feel more certain as to the result. For those who want very early flowers, *L. Harrisii* must be used, but I myself prefer

the Japanese bulbs, amongst which are several splendid forms. They do not suffer from disease like *Harrisii*, and the flowers seem to have more substance in them, though a point in favour of *Harrisii* is its height, which is a great advantage. Another form of *Lilium longiflorum* which commends itself very highly for pot culture is *albo-marginatum*. This makes a lovely pot-plant, the colour of the foliage blending so beautifully with the flower. (Fig. 219.)

Lilies of the Martagon group really want establishing for a year in pots before forcing to any extent, because, making no stem-roots, they have only the basal ones to depend upon. If potted early, before these commence growth, they will flower satisfactorily the first year. I have grown *Martagon album* and *Szovitsianum* well in pots, but on the whole I do not recommend Martagon Lilies for pot culture; they will succeed much better in the open.

This concludes my remarks in reference to Lilies for forcing for decorative effect, and I think that those who require a large display of flowering plants under glass during May will find in these Lilies subjects

FIG. 220.—L. CANADENSE.

that will well repay them, and give an additional interest to their conservatory and greenhouse.

I will now pass to the second portion of my remarks, viz. that of growing Lilies in an unheated glass structure during the summer months. This method, to my mind, is most enjoyable and successful, as with few exceptions all Lilies may be grown in a cool shady house and developed to their full beauty, protected from wind and rain and adverse climatic conditions. In such a structure the requisite degree of atmospheric moisture can be maintained, shade and water supply are under control, and, generally speaking, Lilies can be afforded exactly those conditions under which they grow in their native habitats. All those Lilies previously mentioned will thrive under these conditions, for naturally Lilies that are suitable for forcing will succeed under glass in a cool temperature. *Lilium auratum* and its many fine forms can be grown to perfection, the flowers slowly developing and growing to a grand size. I have been more successful with *L. auratum* in this way than in any other.

Lilium speciosum, in its various forms, is indispensable. I would

recommend the growing of the old *album* and *rubrum*, in addition to the splendid Japanese forms, as these come into flower earlier and help to form a succession. Growers should make a note of *speciosum album novum*, the finest of all the white forms.

Lilium pardalinum, *Grayi*, *canadense* (fig. 220), *superbum*, and others

FIG. 221. - GIGANTIC GROWTH OF L. AURATUM. (*The Garden.*)

of a similar nature, will also thrive under this treatment, and much pleasure may be derived from growing them in pots, as, having no strong scent, they may be brought into the house and used for decoration. As the spikes are not cut, no harm is done to next year's bulb-growth; however, if a suitable situation can be had for Lilies of this the *pardalinum* class, I

would plant them out, as they would eventually be far finer than any pot-grown specimens.

Another excellent Lily for summer pot cultivation is *Lilium tigrinum splendens*. This is very effective, and lasts a long time in flower. I prefer *splendens* to the large Japanese form *Fortunei*, as the foliage of the latter is apt to shrivel and disfigure the plant.

Lilium chalcedonicum, *Krameri*, *philadelphicum*, *concolor*, *Thunbergianum venustum macranthum*—a large, self-coloured, late form—will all succeed under this treatment.

Where a continuous display of Lilies is required throughout the summer, and it is very easy to have such a display, I recommend the starting of some Auratums, Speciosums, and Tigrinums in heat in March or April; these will then come into flower in July, and, associated with those already mentioned, make a fine display.

Where plenty of room under glass is to be had, I would like to see Lilies grown as specimen plants. Six to ten bulbs started in an extra large pot or small tub, and well cared for from year to year, will increase

FIG. 222.—L. NEILGHERRENSE.

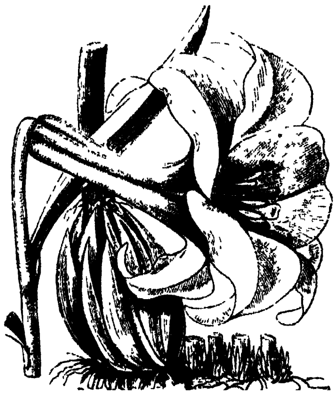


FIG. 223.—L. WALLICHIANUM.

both in number and vigour, and make a grand show. This was done twenty-five years ago, with such Lilies as *auratum* and *speciosum*, and well done, as witness the account of a *L. auratum* mentioned in the *Gardeners' Chronicle* of February 15, 1878. I will briefly give its history. A single bulb was planted in 1865. In 1867 it produced six stems, 58 flowers; in 1869, 39 stems, 108 flowers; in 1870, 48 stems, 208 flowers; and went on increasing still further for many years. Such cases were not rare in those times; and if similar plants were seen nowadays they would cause a great sensation. (Fig. 221.)

In conclusion I have summarised in a few remarks the general conditions under which Lilies thrive under glass, and a few details as to culture.

The general conditions under which pot Lilies thrive are: A cool atmosphere about the roots; shade from strong sunshine; abundance of air, especially on warm days when the atmosphere is moist. Freedom from draught and sudden fluctuations of temperature. Frequent syringings are beneficial twice daily in hot weather. Sprinkling water freely

about the floors and bare surfaces of the house, to render the atmosphere cooler and moister than the outside air. I recommend the using of

FIG. 224.—L. LOWII. (*Journal of Horticulture.*)

rather oversized than undersized pots, placing the bulb in the middle of the pot. In the case of stem-rooting Lilies, top-dress the surface as the

stem-roots form. A good soil would be found in friable loam two-thirds, half-rotted leaf-soil and sand one-third, using in a rough state. Lilies with only basal roots prefer a stiffer soil, and their bulbs need not be placed lower in the soil than is sufficient to cover them. Water should be given carefully, having regard to the fact that two kinds of roots are formed by those Lilies usually grown in pots.

With every Lily try to shade the surface of the soil and the lower portion of the stem either by close planting or by associating other plants with them. Fumigate frequently with a good vaporising compound. Cow-manure water much diluted will help plants bearing a large inflorescence; also lime and soot water in a weak solution will give the foliage a fine healthy appearance.

After flowering remove the plants and plunge them in a half-shady position in the open, and if the weather prove dry they must be watered just sufficiently to keep the soil moist. About November the bulbs should be carefully examined, fresh soil added, and the bulbs replunged in a cold frame.

I find I have omitted to mention the Indian and Burmese Lilies, viz. *neilgherrense* (fig. 222), *Wallichianum* (fig. 223), *nepalense*, *sulphureum*, *Lowi* (fig. 224), and *philippinense* (fig. 225). These are, however, more suited for planting out under glass in the manner practised so successfully at Kew, where they may be seen making themselves almost at home in the Himalayan House, planted out amongst Rhododendrons, Camellias, &c., but this is not possible in the general run of gardens.

Fig. 225. –L. philippinense. (*Gardeners' Chronicle.*)

(*To face page 126.*)

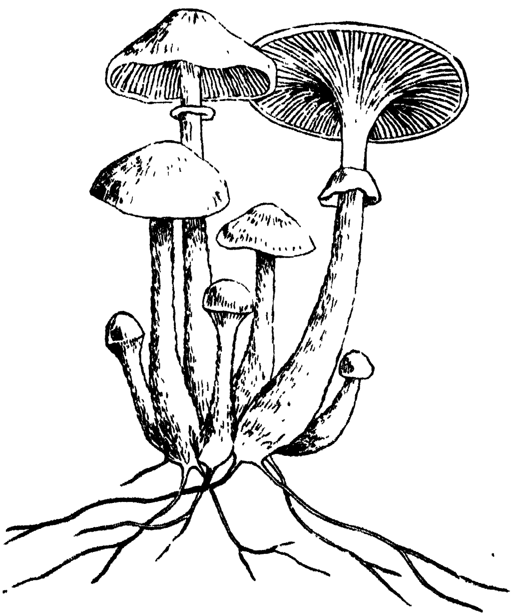
EXTRACT FROM A LETTER TO THE CHAIRMAN ON A SUPPOSED HYBRID BETWEEN L. PARDALINUM ♂ AND L. PARRYII ♀.

By James Snow Whall.

. . . As the Lily was withered when it arrived, I do not wonder at your taking it for *L. pardalinum*, and not a good one at that. Of its hybrid origin there is, however, no doubt.

I made the cross myself in 1893, sowed the seed in October of the same year, and no one else has had anything to do with its cultivation. When you have had an opportunity of examining it closely I think you will see signs of the parentage. I was aware that many Lilies had been said to show no signs of change though carefully fertilised with foreign pollen, and it was this, I think, that led me to experimentalise.

It was not because I think the Lily better than its parents (I do not) that I sent it to you. I thought it would be interesting chiefly because it shows the influence of the pollen parent (*L. pardalinum*) so strongly. This influence is shown mainly in colour and in the reflexing of the petals. In general growth, in the set of the flower on the stem, in scent, and in the form of the bulb, the mother (*L. Parryi*) is visible. After all, I do not know that we want hybrid Lilies ! . . .



VINE CULTURE AS EXEMPLIFIED AT THE PARIS EXHIBITION.

By Sir JAMES BLYTH, Bart.

COMMERCIALLY, the study of the cultivation of the Vine has hitherto had little practical interest for business men, if we except, perhaps, those who are engaged in the distribution of wine.

That these islands, the centre of our dominions for trade and government, do not produce the grape in wine-making quantities, has perhaps been sufficient reason for this in the past. For the future, however, since space and time are gradually becoming annihilated, and the war has drawn closer together the English-speaking people of the world, our thoughts must be increasingly directed not only to our principal Colonies, but to the outer fringes of the King's Empire. As "headquarters staff" of the Imperial Commercial Army, it has, therefore, become more than ever necessary to bear in mind the immense variety and infinite capabilities of the soil throughout our world-wide territory, and, especially for our present purpose, its adaptability to the industry of viticulture.

Our Colonial brethren in Africa, Canada, and more particularly the Commonwealth of Australia—whose new era of Imperial life and Imperial unity has been so fittingly inaugurated by the visit of the Duke of Cornwall and York—are only on the threshold of the science of wine-growing. They have, therefore, still much to learn of viticultural theory and practice from fair and fertile France, whose vast vineyards provide an unexampled object-lesson to the world in the profitable cultivation of the Vine.

Remembering that there are no fewer than fifteen hundred distinct varieties of the grape grown on French territory and available for use in connection with wine-production, and that Australia is some fifteen times the size of France, it will be seen how enormous are the possibilities awaiting the wine-grower in that continent, which in area, soil, and climate is said to be capable of rivalling Europe. Indeed, it would not be surprising if, before the lapse of many years, the British public were provided with pure Colonial beverage wines, cheap as well as abundant, and possessing the additional advantage of having been produced by our own kith and kin.

The Colonial Secretary's project of bringing the produce of British Colonists direct to British consumers—as witness the now accomplished regular transit from Jamaica to Bristol of fruit, picked the very morning of the day the steamer sails—is a striking illustration of what may be done by far-sighted statesmanship to forge fresh links in the chain of Imperial unity.

The recent decision, too, of Lord Selborne and the Lords of the Admiralty to use in future Cape or Australian instead of foreign wines, in connection with the ceremonial christening of British ships of war, even if regarded as a trivial incident, is also a straw happily showing a

drift towards closer commercial relationship, which may likewise have momentous results in developing the idea of Empire among our people who inhabit almost every quarter of the globe.

While we cannot ignore the consideration that climate will have a certain influence on the quantity and kind of wine consumed in countries not producing their own, it has probably received too much prominence in comparison with other factors which govern exports of wine as well as other articles. Thus we find that Brazil, as a former Portuguese colony, is the largest importer of wine from Portugal; and that several South American provinces or States which were colonised by Spain take principally her wines. The practice is simply an illustration of the saying that "trade follows the flag"; which, however, is only to a small extent true where the means of communication are inadequate. The trade of the Iberian Peninsula with South America dates back to the time of Spain's colonising activity, when her galleons carried her wine to America and returned laden with the gold and produce of her dependencies.

To recount this is to emphasise the importance of our home market for the produce of our Colonies, since the Mother Country, ever ready to receive from all parts of the world commodities which cannot be produced under equally favourable conditions at home, specially welcomes from every clime the products of her own people.

If suitability to stand a long voyage be regarded as a leading characteristic of the wine which Australia or the Cape can send to this kingdom, we need not fear that questions of freight will present any serious hindrance. Indeed, if the freights from the Antipodes be compared with those from France, Spain, or Portugal to the British Isles, the difference will not be found of much moment as a commercial factor, bearing in mind the natural preference for the produce of our own Colonies.

The recent Exhibition in Paris, therefore, affords an appropriate occasion to call attention to the culture of the Vine as illustrated by the great French nation, whose extensive and varied experience entitles her to teach all nations the technique of this huge industry.

The varied phases in the progress of the grape from its germination up to its distribution as wine matured for public consumption—in fact, from the vine-seed to the wine-cup—were portrayed in a thoroughly practical manner at that most instructive of international Exhibitions. Hence it is fitting that its educational value concerning one of the greatest and, as it is regarded by many, one of the most beneficent of industries, should be placed on record, so as not to be lost to the commercial community of this Empire.

It will not be possible, within the space of a paper such as this, to make more than a passing reference to the modes of culture which prevail even in the districts producing the wines best known to commerce in this country.

In France the vineyards are worked to-day on methods almost the same as have prevailed for generations. In certain districts, and those producing the most valuable wine, as in Champagne, hoe and hand-labour is the rule; while in others the plough, with either oxen or horses,

is used. A slight preference of late has been shown to the horse, owing to his being a more expeditious, although perhaps a less reliable, worker among the Vines.

The introduction of steam or electric power for cultivating the land may probably change the system of working vineyards, as it is certainly gradually changing the system of working farm-lands.

Owing to the invasion of phylloxera, and the consequent scientific discoveries for its prevention or extermination, labour on the vineyards has become continuous throughout the year. It is a common remark amongst the present proprietors of the Médoc, that in their fathers' time the vines were simply pruned, the land ploughed four times a year, and the grapes gathered at the vintage, leaving all else to nature and the seasons. Now, from the moment the grapes are gathered, scarcely a week —certainly not a month—passes, but some process for the defence of the roots, the stems, or the leaves takes place.

The systems of training the Vine differ widely, as do also the modes of irrigating its roots, and there is also much difference in the extent of pruning. This latter procedure is one which, after all, means deciding for the plant how much of its energies shall be expended on the wood and leaves and the fruit respectively; the process, too, having, of course, its effect upon quality as well.

Visitors to Italy are impressed by the beauty of vines growing on trellises, but the grapes so grown do not produce wine of high quality. A certain limitation of the spread of the shoots is necessary to produce the best wine. If allowed to spread without being cut back, deterioration of quality is the result.

It would be impossible to lay down any definite rules on such a point as this to guide those who, in our Colonies, may enter upon the wine industry. They will have to decide the matter in the light of various factors. Labour is one, and a very leading one—how to obtain it, how to use it. The richness or poverty of the soil is another. These and other considerations of cost and relative profit are further subject to lie of ground, soil, and climate. It would fill a very large volume to write at the necessary length all the instructions and suggestions, founded on the variety of modes of culture which even in France alone prevail. For example, in the Médoc the stakes are short and the vines meet between them on two sides, leaving alleys on the other two sides. In the St. Emilion district the poles are as high as eight feet, and one can walk round each stock. In the Champagne district, too, the vines are likewise grown on poles more like hops in this country. What has determined the mode of training in these and other instances requires careful study. It would be, perhaps, misleading to do more than thus mention a few of them. Only a careful investigation of all the conditions present in each district named would furnish an answer to the why and wherefore of each particular case.

It might be mentioned here that a nursery of young vines is an spe nsable adjunct to every vineyard, where he slips are rooted, and as yearlings, transplanted to their final standing-place.

It is to be hoped that our growing enterprise in the Colonies will never have to pass through the experience to which the vineyards of the

old world have been subject in the last half-century. About 1850 appeared the oïdium, which virtually destroyed the vineyards of Madeira and spread all over Europe.

CLASSIFICATION OF EXHIBITS.

	Number of Exhibitors	Number of Exhibits	Honours Awarded					Total Awards
			Grand Prizes	Gold Medals	Silver Medals	Bronze Medals	Hon'ble Mention	
EXHIBITS OF WINES AND BRANDIES PRODUCED IN FRANCE :—								
Bordeaux districts :—								
Gironde and Dordogne . .	1,602	2,069	11	101	164	193	97	566
Burgundy districts : -								
Côte d'Or, Saône and Loire, Rhône, Yonne . . .	695	1,706	10	111	155	138	79	493
Champagne districts :—								
Aube and Marne . . .	35	186	1	2	8	9	4	24
Saumur and all other districts of France, including : - Seine, Ardennes, Haute-Marne, Haute-Saône, Meurthe and Moselle, Ain and Jura, Savoie, Alpes Maritimes, Basses-Alpes, Bouches - du - Rhône, Corse, Drôme and Var, Aude, Gard, Vaucluse, Hérault, Pyrénées Orientales, Haute - Garonne, Lot, Lot and Garonne, Tarn, Tarn and Garonne, Basses-Pyrénées, Armagnac and Gers, Deux - Sèvres, Vienne, Loire Inférieure, Maine and Loire, Sarthe, Indre and Loire, Cher, Loir and Cher, Loiret, Nièvre, Cantal, Indre, Puy-de-Dôme, &c.	2,642	4,834	11	196	598	452	291	1,548
Cognac districts :—								
Charente & Charente Inférieure	1,328	2,033	6	127	544	187	69	933
Total	6,302	10,828	39	537	1,469	979	540	3,564
EXHIBITS OF WINES PRODUCED IN FRENCH COLONIAL POSSESSIONS : -								
Algeria and Tunis . . .	783	1,100	3	39	137	132	130	441
Total of France and French Colonies .	7,085	11,928	42	576	1,606	1,111	670	4,005
EXHIBITS OF WINES AND BRANDIES PRODUCED IN OTHER COUNTRIES OF THE WORLD :—								
Australia, Austria, Bosnia and Herzegovina, Bulgaria, Germany, Greece, Hungary, Italy, Mexico, Peru, Portugal, Roumania, Russia, Servia, Spain, Switzerland, Turkey, United States of America . . .	1,839	3,915	37	188	371	305	208	1,109
Grand Total . .	8,924	15,843	79	764	1,977	1,416	878	5,114

In 1861 the phylloxera first of all made its appearance. It was not until after 1875 that it obtained a seriously widespread hold upon the

vineyards. It has taken France over twenty years to secure an almost complete mastery over the scourge. Other countries of Europe to which the phylloxera has spread have been, and still are, fighting this worst enemy of the vine, but with a knowledge derived from their neighbours which gives our present growers a great advantage. Without enumerating all the means which are used to treat the soil preventively or remedially, one chief and efficacious method of reconstitution of the vineyards may be mentioned. It was found that in the American wild vine the root, which is the only part vulnerable to the phylloxera, was immune from its attack. Millions of these American stocks have been imported, or struck and grown in France, and upon them have been budded scions of the French vines, with the result that, apart from other remedial measures, the pest can thereby be defied. The loss of the past is, to this extent, gain for the future. Every vine-grower has now at his command defensive and remedial means of fighting the foes of his vineyards. What to use and how to use it is at the disposal of all at very short notice, and it can safely be predicted that never again will so much money value be lost before the remedy for oïdium, phylloxera, or mildew is applied.

The figures regarding the samples of wine, which formed so large a proportion of the number of exhibits submitted to the juries, will better enable the British public to appreciate the importance of the wine industry of the world. This will be recognised if it be borne in mind that out of the 75,000 exhibitors, representing all classes of merchandise and manufactures of every country, more than one in nine, or no fewer than 8,924, were included in Class 60 (wines, and spirits distilled from wine).

They may be classified for British readers as on page 431.

Of the total number of 15,843 exhibits of wines and wine-spirit, 11,928 came from France and her Colonies, and 3,915 from all other parts of the world. And it is therefore not surprising that while these 11,928 exhibits were awarded 4,005 honours, those from other countries obtained 1,109 honours only; although it is at the same time noteworthy that nearly half of the highest awards—*Grand Prix*—namely, thirty-seven out of seventy-nine, were given to foreign competitors.

That France—with some 4,326,000 acres (1,730,451 *hectares*) under vines—is easily first as the leading wine-producer will be apparent from the figures on page 433, showing that her production in 1900 was about half the yield of Europe, and considerably more than a third of that of the globe.

This quantity of 1,482 million gallons produced last year in France will be seen to be the more surprising when it is stated that only a decade ago the production of both Italy and Spain was almost identical with that of France, each country then producing about 600 million gallons annually; while in one year in the eighties Italy actually held the first place for quantity, France being second.

Of the world's production of 3,618 million gallons, 3,403 million gallons were produced almost entirely in Europe, and 206 million gallons in America; while the British Empire, with a vastly larger area than Europe, and embracing, as we have said, every variety of soil and climate,

is only represented by a production of some nine million gallons of wine in 1900, or a four-hundredth part of the whole.

THE WORLD'S PRODUCTION OF WINE IN 1900.

	Gallons	Gallons
France	1,482,000,000	
French possessions—		
Algeria, Tunis, and Corsica	130,000,000	
Italy	583,000,000	
Spain	517,000,000	
Portugal	139,000,000	
Madeira, Azores, and Canary Islands	7,000,000	
Germany	80,000,000	
Austria and Hungary	114,000,000	
Switzerland	35,000,000	
Roumania	92,000,000	
Bulgaria	75,000,000	
Servia	27,000,000	
Russia	53,000,000	
Greece	20,000,000	
Turkey and Cyprus	49,000,000	
Persia	700,000	
		3,403,700,000
United States	32,000,000	
Bolivia, Brazil, Mexico, and Uruguay	15,000,000	
Argentina	41,000,000	
Chili	69,000,000	
Peru	49,000,000	
		206,000,000
British possessions—		
Australia	5,500,000	
Cape of Good Hope	3,500,000	
		9,000,000
Total yield of the world		3,618,700,000

Stupendous as are the figures regarding France, we must not assume that either the area of wine culture or the limit of production has been reached there, nor even that former records have been exceeded. Not only is the planting of new areas proceeding apace, but the production of the present plantings has increased by large percentages, owing to improved cultivation and the measures taken to repair past misfortunes to the wine-growing industry from oïdium, mildew, and phylloxera.

This greater care exercised in planting, and the experience acquired in combating all the enemies to the well-being of the vine, promise not only to conquer these insidious fungoid and insect pests, but to vastly increase the proportional productivity of the areas under vines. How much greater, for instance, is the fecundity of the vine since the steps taken to regenerate the vineyards which have been affected by phylloxera will be seen by a comparison of the annual yield per acre at the beginning and at the close of the last quarter of the century just ended. In 1875, which, as is well known, was a record year in France for quantity as well as quality, 6,250,000 acres (2,500,000 *hectares*) produced 1,840 million gallons (83,632,390 *hectolitres*) of wine, an exceptional average yield of 294 gallons per acre. Yet in 1900 the continuous adaptation of scientific methods, which has been so efficacious in eradicating the parasite, has also been the means of further

increasing the average yield of wine from 294 to 348 gallons per acre. Assuming, therefore, that last year's average per acre occurs at intervals, and that when the gradual replanting of the areas has been completed, the acreage, instead of being 4,326,000, as in 1900, amounts to 6,250,000, as in 1875, the vineyards of France alone will yield in such exceptional years the astounding total of 2,144 million gallons; so that, with her population practically stationary, she will then have 680 million gallons of grape-juice more than last year—a surplus over her own requirements sufficient alone to provide every inhabitant of the United Kingdom with some twenty gallons of wine per annum, as against the half-gallon or less now consumed.

Nothing more conclusively exhibits the efficacy of the replanting in connection with the methods adopted by the French wine-grower—which, while eradicating the phylloxera, have at the same time so fertilised his vineyards as to compel every foot of his holding to yield its utmost—than the steady upward tendency, for many years past, of the volume of grape-juice obtained, as will be seen by the following

TABLE SHOWING THE ANNUAL AVERAGE PRODUCTION OF WINE IN FRANCE DURING THREE FIVE-YEAR PERIODS.

Five years' average 1886-1890	Five years' average 1891-1895	Five years' average 1896-1900
573 million gallons	771 million gallons	980 million gallons

The magnitude of last year's yield of 1,482 million gallons may be appreciated when it is remembered that, enormous as is the beer consumption of thirty-four gallons per head for every man, woman, and child in Great Britain and Ireland—amounting to 1,360 million gallons—yet even this total was exceeded by 122 million gallons of wine in France in the 1900 vintage. This quantity will allow amply for all her exports, and yet provide a surplus of wine for her own use fully equal to the annual beer consumption of the United Kingdom. It is interesting also to recall the fact that, while this enormous production of wine is more than enough for her current requirements, France has frequently in former years had to look to adjoining countries such as Italy and Spain, in addition to her own colonial possessions of Algeria, Tunis, and Corsica, to make up a sufficiency for the normal consumption of her national beverage.

It will therefore be preferable to begin with France as an exhibitor of her own produce, and to touch mainly on the categories of wine best known to this kingdom, and which therefore may probably be found the most suitable varieties for growing in our Colonies.

In view of the fact that the official catalogue of Class 60, under which alcoholic beverages were arranged, contained 637 pages of closely printed particulars of the exhibits, it would be impossible within the limits of this paper to discuss them with anything approaching minuteness. Indeed, commercially speaking, the task when completed would be useless, for it is certain that the enterprising Frenchman and the intelligent importer have long since discovered what wines are suitable for sale in this

and other countries, and that therefore the majority of exhibits of beverage wines can be dismissed with but few words. It is when we come to consider the cultivation and treatment of those varieties of French wine which are known here that both merchant and consumer will take more immediate and practical interest.

Of the fifteen hundred varieties of grape cultivated for wine-production in France alone, the following varieties, after centuries of experience, have been selected as being the most suitable for the class of wine which has become peculiar to the district where they are grown. It should, however, be borne in mind that if wines resembling these in character are to be looked for from our own Colonies or elsewhere, not only the same varieties of grape, but similar conditions of soil and climate will be required.

BORDEAUX DISTRICT:

CLARET.—*Black Grapes.*—Cabernet Sauvignon, Cabernet Franc, Carmenere, Merlot, Malbec and Verdot.

SAUTERNE.—*White Grapes.*—Sauvignon blanc, Semillon, Muscadelle, and Enrageat.

BURGUNDY DISTRICT:

RED BURGUNDY.—*Black Grapes.*—Pineau noir and Gamay.

CHABLIS.—*White Grapes.*—Pineau blanc and Servoyen.

CHAMPAGNE DISTRICT:

Black Grapes.—Pineau noir, Vert doré and Meunier.

White Grapes.—Pineau blanc.

SAUMUR DISTRICT:

Black Grapes.—Pineau noir, Groslot and Cos.

White Grapes.—Pineau blanc and Chenin blanc.

COGNAC DISTRICT:

White Grapes.—Folle blanche.

Of the 10,828 exhibits from France, it will be observed that considerably more than half were from vineyards or districts not provided with designations which would convey any meaning even to the general body of British merchants, much less to the consumers. In fact, out of the 1,482 million gallons produced by France last year, the wines known as *Vins de Luxe*, whether retained for home consumption or exported, probably do not amount to more than 2 per cent. of the whole, or some thirty million gallons—the remaining 1,450 million gallons being *Vin Ordinaire*, simply made by pressing out the pure juice of the grape—black or white—and the natural fermentation caused by its own chemistry, without the addition of alcohol or any other ingredient; and, with the exception of that proportion distilled into brandy, the whole of this vast volume will have been consumed, if not inside a twelvemonth, at least within two years of the vintage.

These 1,450 million gallons of unclassified wines, although slightly varying in style according to soil, climate or aspect, constitute the ordinary beverage of the peer and peasant alike of the actual district where they are grown. They may therefore be put aside with the passing remark that the variety of the wines, and their vast quantity represented by the exhibits, indicate how trifling is our knowledge of the

wine industry of France when it is limited to acquaintance with the names by which the wines consumed in the United Kingdom are popularly known to the average citizen.

But beyond being noteworthy for abundance, France stands pre-eminent in this, that she is famous all over the world, not for one description alone, but for several entirely distinct varieties of wine; the reputation of all other countries being due to one speciality only. Thus Portugal, in the honour-roll of wine, is famous for Port; Spain for Sherry; the Island of Madeira for Madeira; Sicily for Marsala; Italy for Chianti; Germany for Hock; Hungary and our own Cape Colony for the luscious wines known as Tokay and Constantia. France, however, not only amongst ourselves but everywhere, is alike celebrated for her two distinct varieties of red wine, Claret and Burgundy; her two varieties of white wine, Chablis and Sauterne; and her two varieties of sparkling wine, Champagne and Saumur; while in spirits no one would dispute her right to the highest place for her Cognac brandy.

Among the principal growers of wine, France is unequalled as a producer of red wines which can strictly be designated "Natural." Port is a wine which has its fermentation checked at a very early stage of the process by the addition of grape-brandy; and Sherry or Madeira, in virtue of containing added alcohol, although in more limited quantity, are also not, strictly speaking, "Natural" wines. By "Natural" is meant that which is produced most directly from the wine-press by absolutely natural fermentation, without any extraneous help or hindrance to Nature's process operating in the juice of the grape. This term "Natural" may be said to be applicable, as a general rule, to nearly all wines which are drunk as beverages in the countries of their production; but France, in respect of exports to this and other countries, stands first for natural red wines, not only as to quantity, but especially as regards quality.

In every wine-making department of France there are vineyards which have probably never been heard of outside their own communes, where wines are produced which are admirable as beverages for consumption in the districts where they are grown, although they are altogether unsuited for transit either by land or water.

Even Burgundies, although there are so many varieties which stand the journey by rail perfectly, never taste so well where transit by sea is necessary, as it is to this country; and especially is this the case with the choicest growths of the Côte d'Or, such as Clos de Vougeot, Romanée, Chambertin, Corton, &c. It is indeed a well-known fact that, except in the place of their production, the wines of Burgundy are nowhere found in finer condition than in the adjoining country of Belgium, where they are stored in cellars exceptionally well adapted for the maturing of wine; for not even in Paris is there such suitable cellarage as in Antwerp and Brussels.

On the other hand, the wines of the Bordeaux district are so beautifully balanced in all their component parts, and are so perfectly fermented, that they travel all over the world without injury. It may be said with truth that Clarets, be they Château Margaux, or Lafite, or the growth of a small peasant-proprietor in St. Julien or St. Estèphe,

keep equally well everywhere provided they are lodged in moderately cool cellars.

It will probably be news to many that the initial cost of beverage wines in abundant vintages in almost every country of Europe is not far from being equivalent to the price of beer in this country. We of course except those coming under the category of *Vins de Luxe*, or the growths of certain favoured localities, which, by reason of special excellence, the demand of the connoisseur, or even passing fashion, possess an adventitious value often out of proportion to their intrinsic worth. These are, however, but a very small fraction of the whole.

Natural wine is, after all, a more direct product of the soil than even beer, which in its manufacture requires yeast or some equivalent by which fermentation is artificially started. In the production of wine, after the grapes are simply pressed, the juice ferments naturally by its own inherent qualities, and the wine, having been more or less matured, is, when bright, ready for use.

Beer, in its process of manufacture, is made of grain which in most cases has been previously malted, afterwards ground or bruised, then mashed and fermented; a group of processes much more complex than those undergone by wine.

A comparison of the figures of wine and beer production respectively per acre provokes some reflections which may possibly not be without interest to those responsible for apportioning the contributions to the National Revenue from one or other commodity.

Taking the figures already given for France: 1,482 million gallons of wine, grown on 4,325,000 acres, show a production of 343 gallons of wine per acre.

Assuming that land on which barley is grown is of the same average value as the vine-land in France, and that the beer is all made of barley malt only; further, that the acre yields four quarters of barley, and that these thirty-two bushels of barley produce 320 gallons of beer, we have to the good the value of twenty-three gallons of wine per acre towards providing for the doubtless greater cost of labour in cultivating the vine.

Even in this comparison the advantage has purposely been given to beer, for, as we have just pointed out, the process of its manufacture is far more complex than wine. It may therefore be stated, with a considerable degree of certainty, that wine, at the place of its production, is as cheap as, if not cheaper than, beer. If this fact be brought home to the public mind it will tend to dissipate the idea that a cheap wine cannot be genuine, and may also induce our statesmen to reconsider their argument, implied if not uttered, that wine is necessarily a luxury and to be taxed as such, because consumed by, so to say, a higher grade of society than beer, which is treated as a necessary of life. The fallacy of this conclusion regarding wine lies in the fact that, without allowing for increased production, increased facilities of transit, and general cheapening of the article, our fiscal authorities have continued to treat it more or less as an exotic production, which must be dear comparatively, and therefore fated always to pay the taxes payable by luxuries, regardless of whether they are beverage wines or *Vins de Luxe*.

In fact, outside wine-growing countries, wine is regarded from the point of view of the small quantity of grapes or of grape-juice obtainable from greenhouses, such, for example, as exist in England, where grapes form the most luxurious article in general use as dessert; and hence the fallacious idea that wine, if good, must be expensive.

It is not too much to assume that wine might be distributed in this country at a little over the price of beer, if only the duty were proportionate to its possible cheapness as a beverage. France has, in fact, adopted the policy of treating beer and wine as articles taxable at much the same rate of duty. These two beverages are admitted within the city boundaries of Paris, which has lately lowered its *octroi*, at a merely nominal charge beyond the light duty levied by the State.

A heavy duty on beverages, such as is chargeable on natural wines in England, prevents the article being obtainable in the cheapest form, and therefore places it out of the reach of the great mass of the people by reason of the actual impost itself and the distributor's necessary profit on the amount of the duty paid. Reckoning the duty on beer at, roughly speaking, 3*d*. a gallon, if the tax on light wines were reduced to even twice, instead of being five times the impost on beer, the increased consumption would be phenomenal, while if the duties were more nearly equalised it would most certainly advance by leaps and bounds.

An almost incredible calculation has been made with a view to showing how vast would be the difference of the relative consumption of beer and wine in the two countries if the duties were reversed; still, there can be no doubt that the proportions of increase or decrease in either case would be enormous if beer in England paid three or four times the tax levied here on wine, and wine in France paid three or four times the tax there on beer.

If, however, the old legislative formula—the greatest good of the greatest number—which is claimed alike by all Governments is not to become a dead letter, and the whole population are to have anything like equal opportunities of obtaining what is most suited to their necessities, whether wine or beer, then those who are compelled to lead a sedentary life as well as those who enjoy outdoor exercise should receive equal consideration in the matter of taxation, which is the basis of the treatment accorded to the whole population in France in regard to both beer and wine. Possibly (and the remark applies with perhaps greater force as regards children) no greater boon could be offered to the millions inhabiting these islands than to be put upon a similar footing, which would enable each household to exercise freedom of choice as to wine or beer—the juice of the grape or the liquor from malt.

A careful study of the consumption of wine in the United Kingdom during the whole of the century just closed must convince anyone that there is something radically wrong in our fiscal system. In face of a regular increase in population and a still greater increase in the wealth and spending power of the people, which have caused the consumption of most other commodities (including such articles as are taxed to bring in a much larger revenue) to advance progressively, that wine alone, owing to its being looked upon as the greatest of taxable luxuries, should in 1900 be actually consumed in lesser proportion per head, and even perhaps

bring in a smaller revenue than a century ago, is a reproach to our common sense as a nation.

The puny proportion of our consumption of wine compared with the figures given on page 433 is a contrast indeed. The one point, however, which the alert viticulturist of the Antipodes or Africa will no doubt keep in view is that among the forty millions inhabiting the British Isles, not to speak of the present and future millions of Greater Britain, he has a body of customers whose wants, intelligently anticipated, will lead him on to fortune.

CONSUMPTION OF WINE IN THE UNITED KINGDOM AT EACH DECADE OF THE NINETEENTH CENTURY.

Year	Population (approximate)	French	Portuguese	Spanish	Other Countries	Australian	Total
		Gallons	Gallons	Gallons	Gallons	Gallons	Gallons
1800	16 *millions*	80,243	—	—	7,214,509	—	7,294,752
1810	18 *millions*	212,520	—	—	6,308,773	—	6,521,293
1820	20 *millions*	164,292	2,361,471	935,971	1,124,761	—	4,586,495
1830	23½ *millions*	308,294	2,869,608	2,081,423	1,175,120	—	6,434,445
1840	26 *millions*	341,841	2,668,534	2,500,760	1,042,787	—	6,553,922
1850	27 *millions*	340,748	2,814,979	2,469,038	812,457	—	6,437,222
1860	28½ *millions*	1,125,599	1,776,138	2,975,769	1,479,735	951	7,358,192
1870	31 *millions*	4,157,372	2,947,028	6,269,325	1,758,432	36,147	15,168,304
1880	34½ *millions*	6,650,852	2,815,342	4,800,410	1,528,731	55,000	15,852,335
1890	37½ *millions*	5,913,421	3,625,519	3,598,027	1,567,472	314,401	15,018,840
1900	41 *millions*	5,333,093	3,610,873	4,075,106	2,037,494	822,503	15,880,069

It will be observed that at the end of the first sixty years of the past century the consumption of wine was the same as at the beginning—a little over seven million gallons. The effect of the great reduction of duty after 1860 was to double the consumption, which in 1870 had risen to fifteen million gallons, at which figure, notwithstanding the country's great increase in population and wealth, it has practically remained for thirty years. The most unsatisfactory feature, and the most convincing argument concerning the unwisdom of the increase of duty last year, was that the consumption of wine in the United Kingdom in 1900 was nearly a million gallons less than in the previous year 1899.

The merits of the fiscal policy on this question of Great Britain and France respectively may best be illustrated by giving the recent utterances of the Finance Ministers of the two countries.

In his last Budget speech in April, 1901, Sir Michael Hicks-Beach, our Chancellor of the Exchequer, who had raised the wine duties all round in the previous year, said: "I turn to wine—it is a falling revenue —nothing can be got out of wine—absolutely nothing."

A month later in May, 1901, M. Caillaux, French Minister of Finance, informed the Cabinet that the application of the new law which reduced the duty on natural beverage wines, placing them on the same level as beer, had "in the first four months of the present year resulted in an increase of 50 per cent.; the consumption of white wine having largely replaced that of absinthe."

Absolutely the only form of adulteration, if so it can be called, which to any extent is practised in wine-growing countries, is the adding of

sugar to the "must" at the time of pressing the grapes, when, in sunless years, they have not reached their proper degree of ripeness and consequently will not, after fermentation, produce naturally the proper amount of alcohol for the perfect preservation of the wine.

Consequently, the more favourable the season and more bountiful the vintage, the purer is the *Vin Ordinaire* consumed in France, or indeed in any wine-producing country. It is only after a short or unripe vintage that resort is had to methods to make up a deficiency, firstly by imports, upon which an extra duty is levied, from other countries more favoured at the moment by Nature, and then by making *Vin de Sucre.* Unlike beer, wine cannot be produced in absolute accordance with the demand; since, whatever the yield of grapes, the juice must be almost wholly utilised in making wine, and that too at the fittest moment, whereas barley, to say nothing of its substitutes, forming the component parts of beer, is also utilised in the manufacture of other commodities—whether the harvest be abundant or the reverse makes no material difference, the production of beer being governed by the law of supply and demand.

In this connection it should be noted that the process of wine-production is less open to suspicion than other beverages, by reason of the manufacture being limited by circumstances far more exclusively to the use of the fresh grape than are the makers of other beverages to any particular materials. When, therefore, the manufacture of any other beverage is spoken of as involving more complexity than wine-production, it should be remembered that, whereas pure wine is entirely the pure juice of the grape, there are risks attaching to beverages conventionally called pure by reason of the introduction of substances the purity of each of which may depend upon the processes of its own separate manufacture.

A vast number of baseless assertions are made from time to time concerning adulteration of wine, which are the result of ignorance of the facts regarding its production and failure to appreciate the enormous quantity of grapes annually harvested. A moment's reflection upon the comparative simplicity of the process observed in producing wine, as already explained, would show how absurd are the fables about the introduction of other fruits or vegetables—the fact being that in wine-growing countries grapes are cheaper than any other fruit or substitute whatever, whether wild or cultivated.

Indeed, any possible addition of what is foreign to the grape is likely to be for the purpose of improving the apparent vinosity or body of higher-classed wines rather than for the purpose of cheapening the lower category known as *Vin Ordinaire*, which in abundant vintages is cheaper than any feasible adulteration can make it.

In directing the attention of our Colonial wine-growers and landowners to the lessons they may learn from France and other countries as to choice of soil and situation, mode of culture, and precautions against and remedies for vine disease, it is necessary to warn our Colonists against attempting in any one district or expanse of country too much in the way of producing for export many kinds of wine merely because grapes will grow. If we look at France we find a distinctive wine coming from a certain territory, and making, away from its own country, a

reputation in which it stands out as an article separate and generic. This advice is indeed hardly needful for some of our distributors of Australian wines, who have brought these prominently before the British public under distinctive names of their own, and without attaching to them timeworn titles by which the wines of the Continent of Europe are known to the consumer.

We do not in the least despair of seeing wines of the very highest excellence produced, for example, in Australia and South Africa, which will approach the finer growths of France, Portugal, Spain, and Germany; but this will take place not only through the selection of suitable localities and a wise choice of the variety of vine to be grown—be it black or white—but also by a system of painstaking culture which will ensure the high quality necessary to compete with the results of centuries of experience.

If from this point of view we study the wine industry of France, we shall best see what is needed for our own success in the same field of commerce.

We have, in the wine territory of which Bordeaux is both the centre and shipping port, an expanse of country which is fitted to produce natural beverage wines of the most suitable description both for maturing at home and for exporting over sea to all the world. We have, in this district stretching north-westward from Bordeaux, a country nearly one hundred miles long by sixty miles broad. The Médoc, on the left bank of the river, is divided into Upper and Lower, the former, containing fifty-nine out of the sixty classified growths—one, Haut-Brion, a first growth—being in the Graves district. The whole forms a stretch of vine-growing country unexampled on the face of the globe, viewing the extent of the territory, and the fame of its individual Châteaux. The wine throughout this district is stored, not in cellars, but in warehouses built upon the ground level. In fact, this form of store for wines in casks is the usual one in towns as well as at the vineyards throughout the Bordeaux country.

In the Bordeaux district it may be said that as a general rule the finer growths are upon the higher ground, while the less valuable wines come from the lower and marsh lands. Many of the finer Clarets, however, come from the not very elevated slopes of the Médoc, and some few of the most renowned from the sandy flat country of the Graves.

As a matter of fact, there are three varieties of fine Claret—namely, *Haut-Médoc*, including Châteaux Margaux, Lafite, Latour, &c., on slopes *Graves*, with Châteaux Haut-Brion and Pape Clément, on sandy flat lands; and *St. Emilion* and *Fronsac*, on the hills embracing the esteemed Cheval Blanc and the Château Ausone, to which latter was awarded a *Grand Prix*.

The last mentioned are celebrated for their roundness and fulness, which approach the character of Burgundy; and their repute in Bordeaux among the merchants is great, more so than is apparent to consumers here. Of the three varieties mentioned, the St. Emilion wines are those which are grown at the greatest elevation, and this fact is one which must be carefully noted by our own selectors of wine-lands in the Colonies.

Next to Claret comes Burgundy among the natural red wines of the

world. On the "Côte d'Or," or "Golden Slope," which is the "backbone" of the true Burgundy district, the hill-sides give us the choicest growths and higher qualities, while the plains furnish the inferior varieties. Burgundy has always had a strong hold upon the wine-drinkers of Europe, but until of late years has been quite second to Bordeaux in general public demand. Now, however, for various reasons, the public taste has been more favourable to the Burgundian vintages; and these show an increasing hold on public favour, which Bordeaux seems to be losing. Perhaps the warmer and fuller-bodied character of Burgundy has successfully appealed to the middle-class palate, a development of taste which has been also favourable to the introduction of the Australian red wines, which for various reasons of climate, soil, and circumstances appeal more to the public in our northerly latitude than they would have done had they approached more nearly the Bordeaux wines in *finesse* and lightness of character.

The fact that some of the best wines about Bordeaux are grown upon the plain, while the best wines of Burgundy are vintaged from the hill-sides, illustrates well a lesson which we desire to press upon the wine-grower, present and future, in the Colonies. In the Médoc the soil of the plains and the climate combine to produce some of the finest Claret, while the climate and hill-sides of the Côte d'Or together make for the highest excellence in Burgundy. It is thus apparent that, although in the production of the finest article skill will be of much avail, it must be subservient to other ruling conditions of soil and climate in combination.

The quality of wine in each district in France, and consequently throughout the world, depends upon the extent of sunshine and of rainfall each year, and the amount of natural saccharine and therefore of alcohol generated, which may be too much, as it may be too little, to produce the finest types of wine. For instance, perfect specimens of Claret in the Médoc, such as 1864, 1869, and 1875 vintages, will be found to contain between 11¼ and 11½ degrees of alcohol (Gay-Lussac), or between 19 and 20·5 degrees (Sykes); and less successful vintages, such as 1865 and 1870, contain some 12 degrees and upward—an excessive quantity of alcohol for fine Claret—while 1866, 1871, and 1877, which suffered from a deficiency of sunshine and contained only about 10½ degrees (Gay-Lussac), show clearly that a happy mean of temperature is required to produce perfect Claret.

On the other hand, there cannot be too much sunshine nor too low a rainfall for the production of fine Burgundy; and to have known the seasons is an infallible guide to a knowledge of the best Burgundy vintages, the generally acknowledged years being the ever-memorable 1865 and 1870 vintages, with intense heat and small rainfall, when the natural strength was between 13 to 14 degrees of alcohol (Gay-Lussac), which strength will probably accord with the bulk of the best Australian wines being sent to England.

It may correct a very current misapprehension if it is pointed out that the finest *natural* wines are not produced in the hottest countries, but in countries but little over ours in average temperature. The greater the heat the more the saccharine naturally produced in the grape, but it is the presence in the grape of a medium quantity of sugar which apparently

goes to produce the finest natural wines in Europe—as, for example, Hock, Champagne, and Claret. The further south, beyond a certain point, the coarser is the natural wine produced; indeed, the extra heat of the sun has, as in the case of Port, necessitated the checking of natural processes. Unchecked they would generate a wine which, apart from carrying stability, lacks the characteristics which are sought in a natural wine.

The greater the natural amount of saccharine in wine the greater the danger of a second fermentation, and this is particularly the case if, when the first fermentation is completed, a certain amount of unconverted saccharine remains in the wine. This applies to very hot countries like Portugal, where—as we have before explained—the produce can never be exported in its natural state, but must be fortified with an additional amount of grape-brandy in order to preserve the still unconverted sugar, which procedure is the means of producing what we call Port Wine—the French would more correctly call it a *Vin de Liqueur.*

An example of this increasing popular taste for a full red wine, more nearly approaching Port in character, is furnished by the following figures of the

IMPORT OF SPANISH WINES INTO THE UNITED KINGDOM.

	Gallons in 1870	Gallons in 1880	Gallons in 1890	Gallons in 1900
White (Sherry type) . .	5,419,757	3,775,782	2,270,777	1,507,653
Red (Port type) . . .	849,568	1,024,628	1,327,250	2,567,453
Total	6,269,325	4,800,410	3,598,027	4,075,106

The table is also interesting as showing how a wine so popular as Sherry once was has, for reasons impossible fully to divine, fallen from something under 5½ million gallons in 1870 to 1½ million gallons in 1900. Parallel with its decline, however, there appears as compensation to Spain an increase in her red wine, of the Port type—principally Tarragona—of nearly 1¾ million gallons during the same period, which increase cannot but be attributed to the causes to which allusions have been made.

While it cannot be decided offhand whether any locality is suitable to produce a certain kind of wine, it will help those interested if they keep well in mind the facts to which we have adverted, that not only is France the largest, but also the most successful wine-grower of the world, her products giving generic names to the productions of other countries, and also furnishing the prototypes which are set up everywhere for imitation, which is the surest evidence of commercial appreciation of excellence. To boast, as has lately been done, "that in respect to still wines we (Australia) are able to produce Hocks, Chablis, Claret, Burgundy, &c., which are very much superior to anything of a similar class grown in Europe," is to lull to sleep the increasing enterprise of viticulturists in the Colonies, in the midst of a, perhaps, ephemeral popularity, won partly in consequence of the past distress of France from the phylloxera, which cost her, it is said, 400 million pounds sterling—double

her war indemnity of 1870—and partly owing to "the wave of Imperial patriotism," both of which have lately combined to make the opportunity for the wines of Greater Britain.

Turning now to the exhibits of Champagne, if a special prominence is given in description and comment, it is not only because sparkling wines stand first in point of money value per bottle distributed, but that the whole process of production from beginning to end is of a most interesting and instructive character, approaching almost a fine art. Given suitable soil, climate and storage, the industrial experience and patient minuteness in necessary details, which last is so characteristic of the French nation, we do not see why some of our Colonies should not, within a not very long period of years, produce a sparkling wine which will make a name for itself. It is, however, absurd to attempt to put a wine upon the market merely because it can, like all natural wines, be made to sparkle. Some European wine-growing countries outside France have endeavoured to do so without careful investigation of the fitness of the wine to become a sparkling beverage, or of the storage capacity which exists.

One very interesting point about the production of Champagne is that, though a pale white wine, it is produced, as to a very large proportion of the whole, from the black grape, which, under ordinary conditions, would produce a red wine. The juice for producing Champagne is not fermented upon the grape-skins, as in the case of Claret, Burgundy, and other red wines. The grape is lightly pressed and the juice runs off from the skins before fermentation has to any appreciable extent set in. It is necessary to explain that it is the effect of the alcohol, as it is produced by fermentation upon the skins, which liberates the rosy pigment and colours the wine. There are very fine red wines, almost unknown here, but of repute locally—for instance, in Belgium—manufactured from the very same grapes which, otherwise treated, would have become the straw-coloured wine known to us as Champagne.

The exhibit at Paris, in which all the principal shippers were represented, illustrates the various stages of the production of Champagne from grape to goblet.

One stood in a building apparently surrounded by a forest of grape-stocks stretching far into the distance, and under its roof was collected a microcosm of the whole procedure in appliance and manipulation.

It may here be stated that not only is Champagne naturally fitted to stand without a rival in its own category, but the geological formation underneath the surface in the Champagne district admits of vast cavernous cellars being easily burrowed in the grey chalk, thus forming an ideal storage for the wine during the various operations which bring it to perfection for the market. In the cellars of Reims and Epernay—to name only the two chief headquarters of the Champagne trade—lie many millions of bottles in preparation for shipment, and at times millions of gallons in *cuves*, or vats—the word explaining the term *cuvée*, so familiar to Champagne buyers, which, translated, simply means "a vatting."

These *cuvées*—speaking now generally of the usage—are blends of wines selected from various districts of the Champagne region, no one of

which, it is asserted, although with little solid foundation, can with advantage be placed before the consumer singly. The combinations, which include the juice of both black and white grapes, vary, in proportion as well as number, according to the vintage, and according to the judgment or exigencies of the shipper. Run into *cuves* according to the proportions determined upon, the *cuvée*, or vatting, has added to it a small amount—about 1 per cent.—of cane sugar, and is then as speedily as possible drawn off into bottles, which are temporarily corked and binned away in the cellars. In this position the second fermentation induced by this *dosage* of sugar takes place, which not only produces the characteristic effervescence, but completely disintegrates the sugar, the wine being at the end of this stage called *brut*, and indeed sometimes ultimately corked without further addition of *liqueur*, as the final sweetening is called. During the sojourn in the racks before the final liqueuring and corking, each bottle is carefully examined until the necessary brightness is obtained by the deposit on the end of the temporary cork of all solid bodies produced by the fermentation. Formerly it was the universal practice—in the deft momentary removal of the cork—to "spirt" out this deposit by the pressure of the gas, with just enough of the contents of the bottle to remove the substances which would becloud or damage the wine. Of late years an ingenious freezing machine has been introduced, which freezes solid a thin "wad" next the cork of just the needed thickness to remove all that should not remain and which reduces the waste of wine from some 8 per cent. to 2 per cent. After further rest, and, if need be, further treatment for this necessary clarification, the bottle of Champagne then receives its final *dosage* of a liqueur made from the finest sugar, and is then, after being corked, corded and wired, fit to reach us in the form which is so well known. While at times we are inclined to kick against the price which, relatively to other wines, the higher grades of Champagne command in the market, we have to bear in mind not only the high price of land in the Champagne district, but that the processes through which the wine must pass before it reaches the consumer are of a nature which involve, both as to labour required and loss during manipulation and from breakage, a far heavier expense than any other wine needs before it is fit for the market. Foremost among the items of cost are the two corks which every bottle of sparkling wine requires, the first when originally bottled and placed in cellar, and the second, a superior cork, at the time of shipment. The outlay on these, in the case of the more moderate-priced productions of Champagne and Saumur, is large in proportion to the cost of the wine itself.

We must not, however, leave the category of Champagne without turning to an exhibit of a wine the trade in which has of late assumed great dimensions—namely, Saumur, a sparkling wine of real merit, but which only (from the lack of certain characteristics hard to define) just falls short of the highest excellence in quality which always, in articles of commerce, commands a price out of proportion to the actual superiority which can be discerned. Its rapid progress should be a great encouragement to our Colonies to enter upon the sparkling wine industry.

Saumur, it may, however, be safely asserted, could not have existed as a world-known variety in the French sparkling wine trade if the locality

had not, to even a greater extent than the region of Champagne, possessed ready-made storage of great extent and suitability. The subterranean quarrying-out of limestone has, in the Saumur district of the Touraine, left vast caverns which are available for the storing and preparation of the millions of bottles of Saumur wine which are now consumed wherever civilisation has extended. The local storage facilities in Champagne and Saumur must not be lost sight of by our Colonial brethren if this branch is to be successfully developed. The manipulation of the article is conducted on precisely the same lines as that employed for the production of Champagne; and Saumur is distributed to the consumer now at extremely moderate prices to those who are willing to accept it under its own name, while no doubt many a bottle is drunk at much higher price and enjoyed by those who are not sufficiently connoisseurs to judge an article on its own merits. At the Paris Show a special building was devoted to the exhibition of these Saumur wines, the principal shippers of which elected to invite public favour for the wine itself apart from any borrowed glory which might be shed upon it by the more attractive name of Champagne, and they carried off a *Grand Prix*—the same honour as was awarded to Champagne.

Port wine, as we know it in this country, is not a "natural" wine in the sense in which we have used and explained that term. The "natural" wine of the Douro is a full red wine, coarser and fuller-bodied than true Claret, and is the ordinary beverage in the country itself, under the name of *Consumo*, besides being largely exported to the Brazils. It probably would not be popular in this country, with the choice of Clarets and Burgundies before us, whereas "Port," which it becomes when checked in its normal unassisted development, is a wine suited to our climate at all times as a stimulant, used as it is in small quantities, and not as a voluminous beverage such as *Vin Ordinaire* or beer.

Although many are under the impression that the present form and characteristics of Port and its suitability for transit over long distances are due to scientific investigation, these are far more the result of what we call chance than is either known or imagined. For example, perfect as is the procedure now observed in the production of Port wine, it was mere accident, or perchance necessity, which occasioned that method in the first instance. When the war with France debarred this kingdom from the import and enjoyment of her red wines, probably differing but little from those now shipped, a substitute was sought in Portugal, our ally. As, however, her wines in their natural state would not stand the voyage, the addition of alcohol cured their want of stability and made the wine strong, but lacking the characteristic sweetness which rendered agreeable to the palate. Gradually, therefore, the Port wine as we know it was evolved; the fermentation was checked at a very early stage, and the natural sugar thereby retained, with the result we have mentioned. In fact, nearly all preserved wines, whether Port, Sherry, Madeira, or Marsala, owe their individuality to accidental experiment in order to preserve their qualities while travelling, to the great benefit of both producer and consumer, if we would only recognise that by the addition of brandy they are no longer beverage wines.

In like manner Champagne owes its origin to the circumstance that

the wines of that northern district of France were often too unripe, not to say sour, for use, until the accidental addition at one of the monasteries, as it is said, of a little sugar set up a second fermentation, which burst all the bottles not strong enough to withstand the process, revealing the sparkling wine we now know as Champagne.

The nearest approach to Port has been effected in the case of Tarragona (often called Spanish Port); but even here—though their neighbours' every procedure has been studied—the imitation has only succeeded in getting fairly near to the lowest grades of true Port in a wine which, however suitable for general consumption, cannot commend itself to a critical palate, being still regarded, on the market, as silver—not to say bronze—is to gold in value.

If some of our Colonial brethren can find a rugged sun-trap like the Douro Valley, with craggy sides steep sloping to the river, of similar geological formation, and under skies of sunshine of equal but not surpassing heat, they will have a spot for making Port within our own Empire which yet may equal that of our old friend in war and wine—Portugal.

At an early stage of the fermentation of Port wine there is added a certain proportion of brandy—distilled wine—the addition of which prevents further development of alcohol from the saccharine of the grape. The sugar therefore remains, up to the proportion necessary to make the wine what it is—full and round upon the palate, with a sweetness which, since it is the preserved saccharine of the grape, cannot be called altogether artificial, except in the sense that man has intervened in nature's process and checked it for a purpose. Where the wine of the Douro is of superlative body, flavour, and suitability, it is sent here as a vintage wine, under the title of its year, within the second or third year of its existence. It is bottled generally when two or three years old, and then remains the full-coloured and full-bodied wine which, after a lengthy period in bottle is so much admired. If not sold as a "vintage" wine it remains in wood, depositing its colour and other solids very much more rapidly than if in bottle, and gradually assuming that tawny colour, lighter and lighter by age, which we see in the draught Port wines of everyday consumption. We give below the statistics of the shipments, showing the large quantity taken by Great Britain as compared with all other countries of the world, with the single exception of the Brazils.

Exports, in Gallons, of Wine from Portugal to all Countries from 1891 to 1900.

Year	England	Brazil	All other Countries	Total
1891	4,383,225	4,380,580	1,768,355	10,532,160
1892	5,841,080	6,198,500	1,442,560	13,482,140
1893	3,372,950	6,189,530	1,411,510	10,973,990
1894	3,169,515	5,153,725	1,326,065	9,649,305
1895	3,588,230	5,709,175	1,418,065	10,715,470
1896	3,861,240	6,848,710	1,530,190	12,240,140
1897	4,024,080	6,002,885	1,493,275	11,520,240
1898	4,725,695	6,438,965	1,604,365	12,769,025
1899	4,222,225	5,251,015	1,571,590	11,044,830
1900	4,038,570	5,427,540	1,613,220	11,079,330

Port, it may be mentioned, is merely a shortening of the Portuguese name for the place of shipment, which we call Oporto, and which, curiously enough, is called Porto in Portugal and throughout the Continent.

After an experience of almost every wine made upon the surface of the globe, I venture to affirm that Port is a wine which up to now has not been approximately imitated away from its native locality on the river Douro. There is, among the productions grown outside France, much more similarity to Claret, Burgundy, Champagne, or Cognac brandy than there is to the true Port. The honour, therefore, of matching this hitherto inimitable wine may yet be won by our own brethren in the Colonies, though Europe has been baffled in the endeavour.

The details of the making of the many varieties of wine to which reference has been made must, for brevity's sake, be left undiscussed. The main purpose has been to awaken general commercial interest in wine-growing rather than to describe all the technicalities of the industry, and on general grounds of trade policy good will have been done by placing the chief facts and considerations before our commercial men.

That viticulture is of as great importance to the French nation as the other branches of agriculture will be recognised by the high position which has been taken by the Press devoted exclusively to the art of wine-making, and probably no journal published in any country in connection with any science is more instructive than are the *Revue de Viticulture* and the *Moniteur Vinicole* to all who are interested in the production of wine. Each conducted by a body of gentlemen of great scientific knowledge, these representative organs have, more than any other authority, been the means of enabling France—and therefore the whole world—to combat that most gigantic of evils, the phylloxera.

It is the application to new territories under other skies of the accumulated knowledge of France and other countries which will give the speediest results in the future to the enterprising wine-grower. This knowledge lies open to the inquirer everywhere, in France particularly, where the observations of sunshine, temperature, and rainfall have been most carefully observed and tabulated. Would-be wine-growers from all parts of the globe are certain of a cordial welcome throughout the French wine country, and equally certain of obtaining all information bearing on the culture of the vine. At Château Loudenne, in the Médoc, for example, which has been owned by an English firm (Messrs. W. & A. Gilbey) since 1875, an accurate account for the whole quarter-century has daily been kept of temperature, duration of sunshine, and extent of rainfall, all of which factors contribute to the making or marring of a vintage. Also, at every vintage-time, the alcoholic strengths of the separate pressings from each kind of grape—Malbec, Merlot, Cabernet-Sauvignon—have been carefully tested and recorded. All these particulars are put at the service of visitors, and may be obtained and studied by those desirous of entering on vine culture, or who are already engaged in that pursuit.

Reviewing in our minds the respective capabilities of our Colonies, we are inclined to look to the Australian Commonwealth for a very large contribution in the near future to the world's total supplies of light wines of the Burgundy and Claret types from black grapes, the Hock and

Sauterne types from white grapes, and the sparkling from both. We might add, as a probable source of supply for some wines of those descriptions, the Dominion of Canada, from the vineyards of the vast Province of Ontario; and, as a possible contributor not yet entered upon the competition, New Zealand may also be included.

On the other hand, we may look forward with some degree of certainty to our great South African possession resuming its position as an exporter of wine. It is due to the Cape Colonists to say that had the present Imperial sentiment existed during the years when their very excellent strong wines, such as Pontac and Constantia, which have almost dropped out of public knowledge, were being imported, those wines would still have a wide currency among our consumers. There is no reason why, in the future, wines of the Port, Sherry, and Madeira types should not thence be abundantly supplied.

In conclusion, those who would endeavour to extend the growth of the vine in our Colonies, and from commercial motives alone would naturally wish to produce the best type that soil and climate would yield, will do well to recognise the distinct classes of wines which exist in Europe. Seeing that the extra price obtained for the finest article is out of all proportion to its superior intrinsic value, while the actual cost of producing the choicest is not greatly beyond that of the most ordinary variety, the wisest counsel that can be offered is that the grower strive to produce the very best wine possible, either from black or white grapes. There will probably be no difference of opinion that as regards still natural red wine, such as Claret and Burgundy, no country can be more worthy of imitation than France; that in the natural white varieties the growths of the German wines from the banks of the Rhine and Moselle—for the most part the produce of the Riesling or Muscatel grape—will be awarded first honours all the world over, in spite of the undoubted merits of the French wines, Sauterne and Chablis; while the strong or preserved red and white wines, Port and Sherry, the produce of the Alto-Douro of Portugal and of Andalusia in Spain, are examples for all countries; and that, lastly, France is at present unapproachable either in sparkling wine or in brandy.

These are the types which should guide us as to the vines and localities selected in planting vineyards in the Commonwealth of Australia, as well as those in our extended territory in South Africa. To this end never was a more useful lesson than that taught by France at the Paris Exhibition of 1900 to the people of the world, and ourselves especially, bearing in mind that the whole of the countries of Europe which include within their frontiers any vine-growing lands do not equal in extent the vast tracts of territory in our Australian possessions alone.

If, therefore, the information now presented serve to fix the attention of our own people on the nature and volume of this prodigious industry, the partnership in which should in future belong as much to the British Empire as to the rest of the world, it will be a pleasing recompense for any labour involved in its collection and arrangement. And it will be an additional satisfaction if others are encouraged to pursue further this subject of viticulture, which seems the more inexhaustible the more deeply it is studied.

IRIS LEAF BLOTCH.

By M. C. Cooke, M.A., LL.D., F.R.H.S., &c.

For some time past the foliage of *Iris germanica* has been suffering in many places from some disease, which ultimately destroys the plants, and has caused considerable anxiety to cultivators. The leaves become spotted with elliptical or oblong fuscous spots, about a quarter of an inch in length, a little darker at the edge. At length these spots become confluent, until the whole surface of the leaf is brown and dead, whilst the original fuscous spots remain of a paler colour than the surrounding tissue. Often there is no external evidence of the presence of any parasitic mould upon the spots, especially in the spots occurring in the spring, but there is a plentiful fungoid mycelium in the tissues. Ultimately some of the spots, towards the centre, are dotted with little black dots, like pin-points, which represent the mature condition of the black mould which is the source of the mischief.

Microscopic examination reveals the fact that these black dots consist of a tuft of jointed smoky threads, which are unbranched, and proceed direct from the mycelium, at length becoming erumpent, breaking through the cuticle, and then appearing on the surface as black dots. These hyphæ, or threads, bear singly, at their apices, the conidia or fruit of the mould. These conidia are long elliptical, at first colourless, with a single transverse septum, but at length become more elongated, of a dusky olive, with two, or rarely three, transverse septa, the whole surface being rough with minute points. Except for the rough conidia, this mould closely resembles the common *Cladosporium*, from which it has been separated, under the name of *Heterosporium*. This particular species is *Heterosporium gracile*, and has been found on *Iris*, *Friesia*, *Antholyza*, and *Hemerocallis*. A reference to its first discovery in Britain is to be found in *Gard. Chron.* May 1894. In this particular species the conidia measure from 35 to 70 micromillimetres in length and from 14 to 20 in diameter.

In Europe this pest is recorded for Britain, France, Italy, and Germany, and has been reported from New Zealand, Cape of Good Hope, and North America. In its fullest and most strongly developed condition the spots are quite blackened with velvety blotches of the threads and conidia.

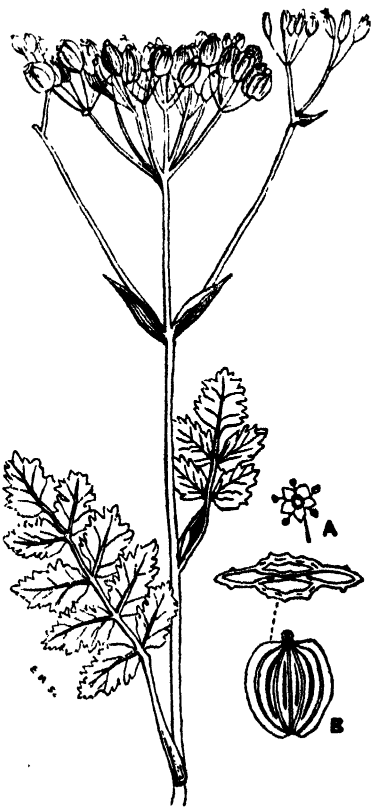
There is no doubt that this and allied species are undoubted parasites of a very destructive character. One species, *Heterosporium exasperatum*, is very destructive to Pinks and Carnations. Another species which I described in 1888, under the name of *Heterosporium Auriculæ*, was found attacking the leaves of Auricula. Another species is found in this country on *Ornithogalum*. In California a species is destructive to *Eschscholtzia*, and another is well known in Europe as a pest on the leaves of Spinach. All of these are parasites, living upon and at the expense of living tissues.

The ultimate question is how to get rid of the parasite and save the plants. This is a question not easily solved where the pest is an internal parasite, developed outwards from the tissues. All that I am able to suggest is that of spraying with ammoniacal copper carbonate solution, which has been recommended as having been tried with success. Of course one cannot be too careful in the clearing away of diseased leaves, and burning them so as to destroy the conidia and check the spread of the disease. In the case of the allied species, which attacks Carnations (*Gard. Chron.* 1886, p. 244) it is said that spraying with potassium sulphide checks the disease.

It may be useful to add that the ammoniacal solution of copper carbonate consists of

Water	16 gallons
Carbonate of copper	1 ounce
Carbonate of ammonia . . .	5 ounces

Mix the carbonate of copper and the carbonate of ammonia and dissolve in about a quart of hot water; when dissolved add sixteen gallons of cold water. There is also another method of preparation, as well as that of potassium sulphide solution, which may be found in Massee's "Text-book of Plant Diseases," p. 37.



BRITISH DYE-PLANTS.

By Dr. Plowright.

The dye-plants of our own country have long ceased to possess any general interest. The introduction of foreign dyes, superior in colour and in many cases in durability, during the seventeenth and eighteenth centuries rapidly displaced the native dye-plants, except in certain specially out-of-the-way localities, such as the Highlands of Scotland and certain parts of Ireland, where they are still employed. We owe to the broad-mindedness of Linnæus a record of such native dye-plants as were in use in Sweden and the North of Europe during the first-named period. In his "Amœnitates Academicæ" he published a paper by E. Jörln, of Upsala, containing an enumeration of the plants in question. In Withering's "Systematic Arrangement of British Plants," numerous interesting notes are appended to the descriptions of many species. Amongst these notes one finds recorded their tinctorial properties. This information appears largely to have been derived from the "Amœnitates," but by no means entirely; for quotations from Lightfoot's "Flora Scotica" (1777), Pennant's "Tours in Scotland" (1782), and Rutty's "Natural History of the County of Dublin" (1772) are also made. The fourth edition of Withering's work, published in four octavo volumes (1801), enumerates some fifty species as possessing tinctorial properties. During the past two seasons, 1900 and 1901, I have, with the help of many botanical friends, who have aided me by collecting material, put to the test of actual experiment about sixty reputed dye-plants, the results of which I have the honour of submitting to the Scientific Committee.* The object in view was, not so much to test exhaustively the capabilities of these plants by the aid of modern mordants, as to see what colours they would produce with such simple chemicals as were available by our ancestors some two or three centuries ago, when home-spinning and home-dyeing were carried on in every house in our country districts. These substances were, first and foremost, alum (a salt known to Pliny), copperas (sulphate of iron), pearlash, ammonia, and lime. These sixty plants have yielded some 150 varieties of colour, the specimens of which are before you, arranged, not as a dyer would arrange them, according to colour, but botanically, in their natural orders.

It will be seen at a glance that some shade of yellow is the most frequent colour the wools have taken. In the majority of cases this is probably due to xanthophyl, and is of doubtful stability. In conducting these experiments it was noticed again and again how almost every green plant, when boiled with the wool, gave it a yellow colour on the addition of alum as the mordant. It seemed as if the alum analysed the chlorophyll

* This paper was illustrated by a most interesting exhibit of three very long series of 150 skeins of wools dyed with native dyes. The paper unavoidably loses a little of its interest and much of its attractiveness by the impossibility of reproducing all the colours, tints, and shades obtained. It must suffice to say that the general tone and effect of the various dyes was very distinctly and beautifully in the direction of what may be best described as High-art shades.—Ed.

by fixing the xanthophyl upon the wool. Such diverse plants as *Thalictrum flavum*, *Anthyllis Vulneraria*, *Myrica Gale*, *Stachys sylvatica*, *S. palustris*, *Polygonum Persicaria*, *P. Hydropiper*, *Humulus Lupulus*, as well as the leaves of Pear, Plum, Birch, Willow, &c., all gave this colour. These yellows are all pale, and are darkened by alkalies, either potash or ammonia. The yellow from *Senecio Jacobæa* is largely used in the Highlands, where this plant is known by the name of 'Stinking Willey,' a designation given it in detestation of the general who commanded the English forces at the battle of Culloden. Certain yellows, however, had obtained so great a reputation as dyes in the time of the older botanists that they then received the word *tinctoria* for their specific names, viz. *Genista tinctoria*, *Anthemis tinctoria*, and *Serratula tinctoria*.

The best yellow is produced from *Reseda Luteola* (Weld), a plant used by the professional dyer until quite recently. It owes its tinctorial properties to an alkaloid,—luteolin. *Genista tinctoria* was used well into the middle of the nineteenth century: it gives a good permanent yellow, but not so pure a colour as Weld. Formerly, however, it was preferred by the dyers to all others for wool that was to be dyed green. This constituted the green colour of the cloth for which the town of Kendal was celebrated in bygone times, reference to which occurs in Shakespeare, in 1 *Henry IV.* ii. 4:

> How couldst thou know these men in Kendal green?

and also in Sir Walter Scott's "Lay of the Last Minstrel," iv. 14:

> The Kendal archers all in green.

Three of the *Compositæ* give yellows approaching orange, namely, *Anthemis tinctoria*, of which the tint is the lightest, but admittedly fast. *Chrysanthemum segetum*, and *Bidens tripartita*, the last named being the most beautiful. It is developed only on the addition of alum.

Of browns there are many, a round dozen, from Alder bark (*Alnus glutinosa*) alone, variously modified by potash, which gives tints of red, or "saddened by copperas," which gives shades of black. These colours are all tannin derivatives. Somewhat similar colours are obtained from Birch bark (*Betula alba*), and Oak (*Quercus Robur*). Yellow browns are obtained from 'Ling' heather (*Calluna vulgaris*), and the barks of the two *Rhamni* (*R. Frangula* and *cathartica*). The fine russet brown obtained from the lichen known as "oaklungs" (*Sticta pulmonacea*) is one of the best in the series. The well-known crottle browns, from *Parmelia saxatilis*, *omphaloides*, *caperata*, and *physodes*, do not differ greatly from one another.

Probably the richest and best brown is that from fresh walnut husks—a dye used by the professional dyers up to quite a recent date. No mordant being required the wool dyed by means of this substance is soft and free from all harshness. Not far behind it is the colour obtained from the rhizome of the white Water-lily (*Nymphæa alba*), a dyestuff used in the Hebrides in the time of Pennant's visit (1782).

Of simple greens there are not many representatives, the best and most durable being obtained from a ground dye of woad "topped" with weld (*Reseda Luteola*). This probably constituted the Lincoln green of

Robin Hood fame. It is alluded to by Sir Walter Scott in "The Lady of the Lake" (v. 17):

Four mounted squires in Lincoln green.

Wool thus dyed may be obtained in many shades, depending upon the depth of the original blue. Some of the lighter shades are very beautiful, approaching the so-called grass green, to which Chaucer refers in his poem of "The Flower and the Leaf":

Freshly yturfed, whereof the greene grass
. . . most like to greene wool.

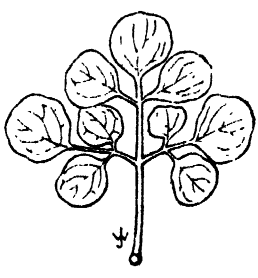
In addition to the Kendal green previously referred to, specimens are shown in which the yellow has been supplied by the fresh inner bark of the Crab Apple (*Pyrus Malus*), of the Ash (*Fraxinus excelsior*), and by the root of the common Dock (*Rumex obtusifolius*).

Less brilliant greens are obtained from the ripe berries of the common Privet with alum, and the flowering tops of the common Reed (*Phragmites communis*) with copperas. Not a single really good red is obtainable from any British plant, whereas Sir Thomas Wardle found red to be the commonest colour in the dye-plants of Asia when he examined them some years ago. The beautiful but fugacious cudbears from the maceration with ammonia of the thallus *Lecanora tartarea*, *Umbilicaria polyrhiza*, and *Urceolaria scruposa* are represented.

The dull reds of *Potentilla Tormentilla* and *Comarum palustre* require a trace of potash to develop them. The fast if not brilliant madder red of the root of *Galium verum*, with the more beautiful pale orange, are the only representatives of the *Rubiaceæ* shown. Perhaps one of the specimens nearest to red is that dyed by the fresh inner bark of *Betula alba*.

One plant only yields a blue colour—*Isatis tinctoria*, the well-known Woad. Various shades are represented which possess certain peculiarities in tint that are greatly admired by those persons who appreciate "art colours." Mr. W. Croysdale, of Leeds, tells me that these peculiar tints can be produced in indigo in certain conditions of the Woad-indigo vat, but to go into the subject of Woad, and the process of dyeing with it, must be reserved for a future occasion.

For help and material my thanks are due to Mr. Angus Grant, of Drumnadrochit; Mrs. Alexander Grant, of Loch-en-Eilan; Mr. Wm. Phillips, F.L.S.; Mr. E. M. Holmes, F.L.S.; Mr. R. V. Tellan, Bodmin; Mr. J. Martindale, Kendal; Mr. G. F. Scott-Elliott, Glasgow; Mr. Carleton Rea, Worcester; Sir Thomas Wardle, Leek.



OBSERVATIONS ON SOME OF THE PLANTS EXHIBITED.

By Rev. Prof. G. HENSLOW, M.A., V.M.H., &c.

[July 30, 1901.]

HELIOTROPE.—The European species, *H. europæum*, was long known by this name, which means "sun-turning." The popular idea of the Middle Ages was that it "turned to the sun"; but Gerarde, who published his "Herball" in 1597, observes that the real meaning was that it flowered about the time of the summer solstice, when the sun turned in its course. Another name was *Solsequium*, from *sol* (the sun) and *sequor* (to follow), but several other plants acquired this name, especially among Composites.

Another peculiarity in the Heliotrope resides in the structure of the pistil; for, excepting the Periwinkle of a different family, it is the only known plant which has the stigma *below* and not at the *apex* of the style. It forms, in fact, a stigmatic ring round it. The explanation of this unique peculiarity is not known.

CELOSIA PYRAMIDALIS.—Fine specimens in Mr. Jones's collection showed the primitive form from which the Cockscomb has arisen. It is remarkable for the numerous branchlets covered with purple bracts. It was thought that the "fasciated" stem, known as the Cockscomb, was due to the fusion of the numerous floral branchlets into the well-known flat massive structure. Such an interpretation would not be correct; for when two branches or organs are fused together, the epidermis of each is suppressed. In the Cockscomb the only elements to represent the branches are the internal fibro-vascular cords which are present in a single flattened stem, surrounded or enveloped in a common epidermis.*

LOBELIA CARDINALIS.—This old-fashioned flower was selected as illustrating the probable origin of the great family of *Compositæ*. The character of having the florets in heads, it was pointed out, is not the only one; as the species of Scabious, of which specimens were exhibited, have their inflorescence similarly in heads, but they do not belong to this family. The most distinguishing feature is that the anthers are united, forming a cylinder. This is also the case with *Lobelia*. In both this genus and in the *Compositæ* the method of insect fertilisation is the same, in that the style continues to elongate till it has thrust the closed stigmas through the anther-cylinder. In so doing a tuft of hairs on the style sweeps out the pollen. It is not till this is effected that the two style-arms with their stigmatiferous surfaces open and become spread out. If a flower of *Lobelia* be compared with a disc-floret of *Centaurea*, the similarity will be at once seen. It is consequently suspected that *Lobelia* represents the line of evolution which issued in the great family *Compositæ*.

DELPHINIUMS, SINGLE AND DOUBLE.—Larkspurs are characterised

* The reader is referred to the author's previous paper on "Fasciation and Allied Phenomena" at page 155.

by having one sepal spurred, and two petals with nectariferous appendages included within the spur of the sepal. In the double forms the sepals are regular and the petals multiplied, and all are without the appendages. The first step is for the flower to revert to the ancestral condition of regularity without spur or nectaries, and the second to multiply the petals.

GLADIOLUS AND MONTBRETIA.—These two genera belong to the same family as the Iris (*Irideæ*). They both have "guides," consisting of deeply coloured streaks or spots indicating the direction leading to the honey; but while the irregularity is more pronounced in the Gladiolus, the "guide" is limited to the front leaves of the perianth. *Montbretia* being more nearly regular, the dark spots are distributed more evenly round the base of the perianth-leaves. In the trumpet-shaped flowers of *Gloxinia*, now raised by florists, not only has the form of the flower become perfectly regular and symmetrical in shape, but the colours are also equally distributed.

GYPSOPHILA PANICULATA, fl. pl.—A new plant to cultivation is the double form of this favourite, exhibited by Mr. Johnson, and one likely to prove useful, as the flowers remain so much longer than do the single.

PENTSTEMON, MIMULUS CARDINALIS, VERBASCUM and SALPIGLOSSIS are plants which illustrate difficulties which systematic botanists meet with in classifying plants. The first three are included in *Scrophularineæ*, which is well illustrated by the Foxglove and Snapdragon, and characterised by having only four stamens, two of which have long filaments and two have short ones. *Pentstemon*, however, as the name implies, has five; but one bears no pollen. In the Mulleins (*Verbascum*) there are also five, and the posterior one is barren; moreover the corolla is nearly regular. *Salpiglossis* has been placed in three different orders by botanists! It now rests, according to *Gen. Pl.*, in the Potato family, *Solanaceæ*.

A regular corolla with five stamens is characteristic of the family *Solanaceæ*, which contain the Potato and Deadly Nightshade. Hence the above genera represent transitional or intermediate forms.

It was the discovery of a vast number of such, both between species of plants and animals, that led to the establishment of the doctrine of Evolution. For although, when few plants and animals were known, they seemed very distinct and easily defined, as knowlege of organised beings increased the different kinds were often linked by such fine gradations that the idea of their having been separately created was proportionally improbable; and that they had been evolved one from another was far more likely. The late Mr. G. Bentham, in working up the *Compositæ* for the "Genera Plantarum," said that he could not find any well-defined character for separating no less than ninety genera in the tribe *Asteroideæ*.

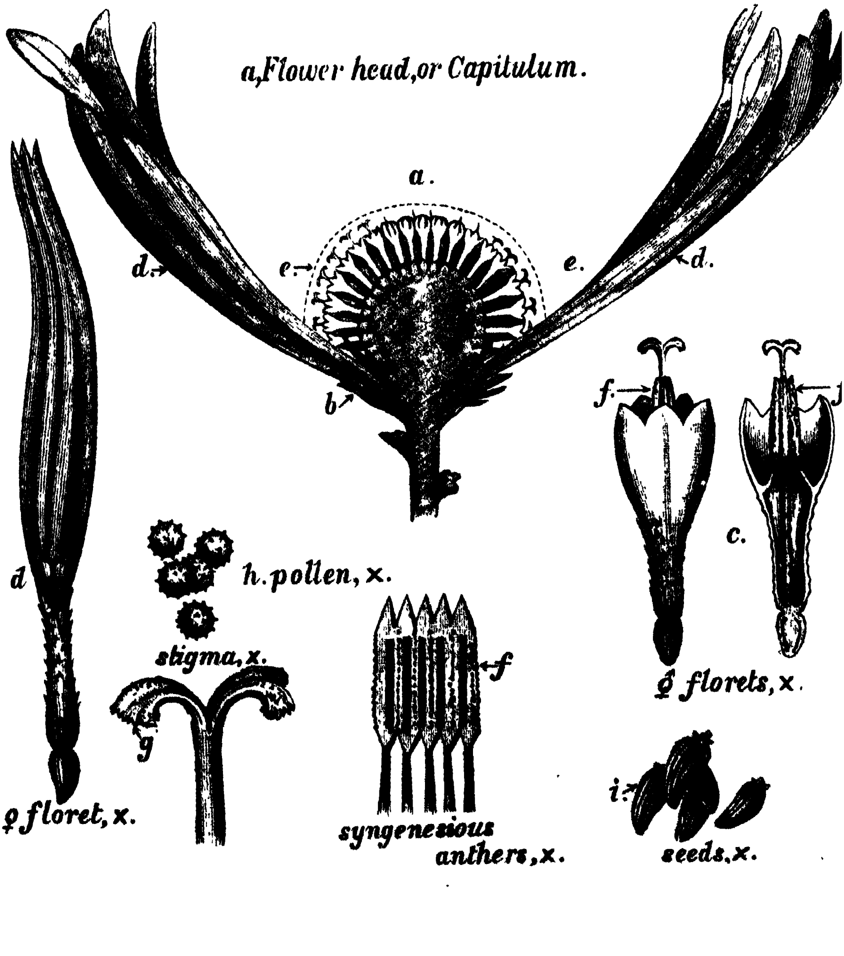
CANNA and WATER-LILY.—These genera, the former a Monocotyledon, and the latter a Dicotyledon, illustrate the method adopted by nature of making petals out of stamens; for although this is obvious in the case of double flowers, as may be readily observed in a semi-double Rose, for example, yet such are abnormal cases; but in that of the above genera

the transitional conditions are normal, and characteristic of the flowers in question.

ACANTHUS.—This plant was alluded to as the one the foliage of which suggested the form of the Corinthian capital to pillars, so often employed in architecture. It is a common plant of South Europe, frequently seen by roadsides &c. in Malta.

ACONITUM NAPELLUS.—This was referred to as being the most deadly poisonous of our British wild flowers, whole families having died through eating the root for Horseradish. Though the form of the *root is conical* and the colour *dark brown*, while that of the Horseradish is *pale* and the shape *cylindrical*, yet in the limited space of a cottage garden both are often grown near to each other,* the Aconite being an old-fashioned garden flower. The result is that in winter the one has been dug up for the other and eaten with fatal results.

* In order to avoid catastrophes the reader is referred to the present writer's *Poisonous Plants* (S.P.C.K.)



GREENHOUSE AND HOTHOUSE PLANTS FOR THE OUTDOOR GARDEN DURING THE SUMMER MONTHS.

By Mr. Wm. Townsend, Head Gardener to Sir Wm. Jas. Farrer, Sandhurst Lodge, Berks.

[Read August 13, 1901.]

Many a greenhouse and so-called hothouse plant may be made to do good service in the flower-garden—in beds or marginal borders, or upon the grass. Only those who have seen them grown with this object in view can form any adequate idea as to their utility and beauty. Fuchsias are frequently used, but when planted in masses are not so beautiful or so effective as when grown into specimen plants, being then grouped so that the light and air can act their part in plant life. Two methods are open at least, whilst others might suggest themselves, to plant or plunge in beds or upon the grassy lawn. Such arrangements constitute a pleasing departure from the too frequent masses of scarlet Geranium or yellow Calceolaria. Another advantage with the Fuchsia is that of withstanding changes of weather, and of temperature too, with impunity, whilst the autumn frosts will do but little injury. The same remarks apply to *Habrothamnus Newelli* and *H. aurantiacus*, which, as tall plants, are seen to the best advantage possible. The Abutilons are another case in point, such, for instance, as 'Canary Bird,' 'Boule de Neige,' and 'Brilliant.' These will frequently escape frost when dwarf plants are injured thereby. Large plants of *Plumbago capensis*, of *Solanum jasminoides*, and Ivy-leaf Geraniums are other examples, the utility of which can scarcely be doubted. It will be apparent that plants so recommended cannot be raised from the cutting stage in one season, such as the Plumbago, for an illustration, which needs to be two, three, and even four years old to produce the best effect—Abutilons from two years upwards; Fuchsias come into use the first season onwards, summer-struck cuttings of these, if grown on through the first winter, even forming a fairly good standard. The Ivy-leaf Geraniums as standards are not so good as Fuchsias, but as pyramids they are excellent: these, if grown on the following season, will make large plants.

At Sandhurst Lodge many greenhouse and hothouse plants, so called, have been cultivated during the summer months in the open air. Many of these have proved very ornamental when so treated, having previously been grown into good-sized plants under glass. Out-of-doors they are plunged slightly below the rims of the pots, being grouped on the turf in suitable and congenial positions, with appropriate backgrounds of greenery.

The plants so grown and treated consist of *Solanum jasminoides* (3 to 5 ft.), *Lasiandra macrantha* (5 to 7 ft.), *Habrothamnus Newelli* and *H. aurantiacus* (5 to 8 ft.), *Begonia corallina, B. Ingrami, B. fuchsioides* (4 to 8 ft.); Scented-leaved and Double-flowered Geraniums (Zonals), with *Salvia splendens grandiflora* (all from 3 to 5 ft.); Heliotropes in variety

(4 to 5 ft.); Petunias, single-flowered, tall growing varieties (3 to 4 ft.); *Streptosolen Jamesonii* (4 to 5 ft.); *Erythrina Crista-galli* (4 ft.); Fuchsias in variety, both double and single, grown as standards, pyramids, and bushes (3 to 6 ft.); *Hydrangea hortensis* and its varieties are grown largely; *Bougainvillaea glabra*, Sanders's variety, will do well if it can be started early and afterwards properly hardened off.

Many visitors to these gardens wonder how these large plants are safely kept through the winter months. To accomplish this a knowledge is required of how much rough treatment these, and kindred plants, will withstand without any serious amount of injury. The Lasiandras, the Begonias, the Heliotropes, the *Bougainvillaea*, and the *Streptosolen* require a certain amount of warmth (a temperate house so designated will answer the purpose well, *i.e.* a house intermediate between the stove and the greenhouse, with the maximum of light).

The *Erythrina* is safe in a cold pit from which the frost is excluded, the growths being previously cut down. A cold frame will suffice for *Physalis Francheti*, a plant that is also used, and which in many localities is quite hardy. A vinery at rest will answer well for storing the Habrothamnus, the Solanums, the Zonal and Scented-leaved Geraniums. A cold frame will be ample for the Hydrangeas in cold localities, whilst in favoured spots they are hardy, or comparatively so. The Salvias are those that are held over after being used for the early winter decorations of rooms and the conservatory. The Petunias are sown early and potted four or five in a pot, being shifted on until pots eleven and twelve inches in diameter are required. The Fuchsias are all stored away thickly until the middle of February in stokeholes or other places from which the frost is excluded: these are not allowed to get dry at the root. During February, from the middle of the month onwards, we commence potting, the houses being by this time free from the Chrysanthemums. The plants that are already in large pots are taken out, the pots being cleaned, and the plants replaced in them after the balls have been considerably reduced. We are in the habit of using for this purpose three parts of good fibrous loam and one part of leaf-mould, and in addition a little bone meal, wood ashes, and soot as a slight stimulant. Such plants as Geraniums, Lasiandras, Heliotropes, Habrothamnus, Streptosolen, Salvias, and Begonias are grown in a little warmth until the end of March, but the Fuchsias, Solanums, Erythrinas, and Hydrangeas are grown in cold houses and pits. I find it better to bring all of these plants along as hardy as possible.

In April we commence to harden off by getting the plants which have been grown in a slight warmth into cold houses and pits, gradually bringing them to withstand exposure to the sun and air. By the middle of May most of these plants can be stood out in sheltered positions to finish hardening off. The Begonias, Heliotropes, Salvias, and Lasiandras should, however, be kept under glass until the end of the month.

The first week in June we begin to plunge the plants out into their summer quarters in the flower garden, so that the pots are hidden in the grassy growth. One very effective arrangement is upon a sloping bank, a large Spanish Chestnut-tree forming an excellent background with its branches touching the ground. In this group some seventy to eighty

plants are arranged, with just sufficient room between each plant for the convenience of cutting the grass and for watering. This arrangement is done in quite an informal manner, being seen to advantage either from below or above. In another place a large Yew-tree forms a background for a group of large Fuchsias, and in another spot, near the house, is a group of Scented Geraniums, whilst a collection of Double-flowered Geraniums have as a background a Laurel hedge: these are seen at a distance very distinctly. *Solanum jasminoides* plunged near trees and shrubs, and afterwards allowed to ramble at will, is very pretty. *Cobaea scandens* and *Mina lobata* are also suitable for this purpose. *Hydrangea hortensis* is plunged on the bank of a ditch of running water and in other suitable places. Every advantage is taken of any corner or nook, shady and otherwise, for plants quoted as examples, especially Fuchsias.

During the summer close attention is required for watering and other routine work. Manure water is applied in weak doses (strong doses do more harm than good); soot, guano, and farmyard liquid are recommended. As the summer advances and the plants become pot-bound, the use of stimulants is more apparent; then the plants will need looking over twice daily. A light top-dressing of good rich soil will greatly assist the plants at this stage. All things being favourable, the flowering season is prolonged well into the late autumn, frequently until the end of October is in view.

Two illustrations will suffice to give an idea of the informal rather than the formal style of filling flower beds, whilst variety is also afforded.

First, a circular bed of, say, 14 feet in diameter: for the centre take *Habrothamnus Newelli*, from 7 to 8 feet high; around this centre group *Abutilon* 'Canary Bird,' about 5 feet high; next to these the same *Habrothamnus* may be repeated; then Fuchsias (standard or pyramidal) can follow; and towards the edge *Habrothamnus aurantiacus* will afford variety and contrast. Any suitable carpeting plant that might suggest itself could be used underneath these taller plants—such as the dwarf semi-tuberous Begonias forming a good marginal edging, or, if a permanent edging be desired, *Euonymus radicans variegata* is a capital choice.

Secondly, an oblong bed, say 26 feet by 12 feet; as a centre to this employ a tall plant of *Plumbago capensis*, 7 to to 8 feet high; on either side *Habrothamnus Newelli*, next to which *Solanum jasminoides*, and two more of the same *Habrothamnus* towards the extremities through the centre; on either side of the centre and 2 feet from it plant Fuchsias (standards) in variety, with stems about 3 feet 6 inches high, eight on each side; the next row may run quite round the bed, and it may consist of Ivy-leaf Geraniums trained as pyramids, and in various colours; as a carpeting to these, Verbenas, Violas, and Petunias are suitable; whilst as a margin the fibrous-rooted *Begonia* 'Fairy Queen' will do well, or *Lobelia speciosa* (blue) would be an alternative. Such a bed as this produced a good effect here, even into the late autumn.

Discussion.

Mr. Hudson, V.M.H., stated that he had visited the gardens at Sandhurst Lodge, so well managed by Mr. Townsend, and had been much

interested in the methods there adopted. Many valuable suggestions and ideas may be noted there which, if carried out in other places, would add a charm to the surroundings and in some measure abolish the monotony so frequently seen in summer bedding. Among other plants named he observed *Begonia corallina* doing well under an Oak-tree, plunged as suggested by the writer of the paper. The *Swainsonia* was also used to a good purpose (*S. galegifolia* and *S. g. alba*). He thought he was correct in stating that the soil there was light with a peaty tendency. This would be all in favour, as contrasted with a cold clayey soil, for such purposes. By exposure and by root-limitation the growths made by these and kindred semi-tender plants would be well ripened; hence a slight autumnal frost would not be so destructive as to planted-out subjects, which in the late autumn become soft and sappy. Many so-called summer-bedding plants are not so hardy as those quoted by Mr. Townsend. Many greenhouse plants are hardier than some of us imagine; e.g. *Lapageria rosea* is a case in point, to which more harm would accrue by exposure to the heat of the sun than by a frost. The best place to plant it is against a north wall.

Mr. A. Dean added that he had seen the charming gardens in question, stating that Sir William Farrer is an enthusiastic gardener. Many others might, he thought, adopt this system of plunging in pots for summer effect in the flower garden.

GARDEN MANURES.

By Frederick J. Baker, F.R.H.S.

[Read August 27, 1901.]

For the purposes of this lecture it is felt that something different from tables of analyses and accounts of experiments which have been tried and reported many hundreds of times is desirable. Yet we do not want far-flown theories. We rather seek to give a few well-proved facts which are either not so well understood as is desirable, or their importance not sufficiently appreciated. Science has done much, very much, to help the practical cultivator; yet a misconception of its real teachings has led to many errors, foremost among which, probably, are the fallacies respecting plant ash. One has heard it stated that in the near future the cultivator would only have to get his soil analysed and then turn to tables of the composition of the crops he wished to grow to supply what is lacking, and all would be well. Alas! that such statements should ever have been made. Our knowledge respecting the ashes of plants is useful if considered with several other factors, and the whole tested. We know that, although the most abundant constituent of the much-used superphosphate is a compound of lime, yet it is essential that another form of lime should exist in the soil to render the whole harmless, *i.e.* to neutralise the acidity.

In dealing with manures our first consideration should be *the soil*. This must supply, under ordinary conditions, both a home and food for the plants. Manures should supply what is deficient. The fact does not seem to be sufficiently realised that every rod of ordinary soil to a depth of 1 foot contains upwards of 20 lb. of each of all the important ingredients of plant food (*i.e.* N, P, K), and most garden soils *very* much more, or, in other words, sufficient for all the plants which will grow there for many years. This large amount is of course chiefly in an inert condition, although it may, by suitable means, be brought into an available form. In order that plant food may be taken up by plants, it must be soluble and *diffusible*.

Water is necessary to carry it into the plant. This is most essential. Hence for the well-being of plants we must have a suitable *soil*; well aërated, containing *sufficient* moisture, not too much, or it will prevent the soil being aërated, and not too little, or the soil will hold it too tenaciously and plants will wilt, although there be *some* water in the soil. Given these and other necessary conditions, the plant will take in such food as is available, or can be made so by the plant. How, then, may we work *the soil*, that it may be the best possible home for plants? It must be in a good physical condition, pervious to air and water, yet retentive, holding water and plant food in such a manner that plants can absorb them. The two chief means of getting it into this condition are farmyard or other *organic* manure and tillage. Here let us emphasise the fact that the special merits of *organic* manures are the alterations which

they bring about in the physical state of the soil—the state just indicated as being so desirable. The plant food contained in these organic manures is, for the most part, unavailable, although *in time* it becomes available. The immense importance of the physical properties of farmyard manure and similar substances is such that we cannot fairly compare them with chemical fertilisers.

Another substance which largely alters the texture of soil, and which there is a tendency in the present day to neglect, is lime. This substance, whether used as quicklime, slaked, or the more common, because naturally occurring, carbonate, as chalk or limestone, is most essential. A continual leaking away of this as soluble bicarbonate and as nitrate has ever occurred, but never to such an extent as now, when so many chemical manures are used. By way of illustration we may note that every particle of ammonium-sulphate requires a particle of lime to combine with the contained acid, and yet another to unite with the nitric acid which is formed. Most of the unused nitrate formed by the decomposition of organic matter (humus) in the soil also passes away as nitrate of lime. Similarly, superphosphate requires a great deal of lime. That the acidity of soil, due to lack of carbonate of lime, is frequently the cause of many failures in *pot culture* and *borders*, there is abundant evidence to show. Nor is this to be wondered at if we reflect that old rotten turves and other ingredients of potting earth, admirable though they be otherwise, are commonly deficient in carbonate of lime. Lime in some form, preferably a small quantity of quicklime, intermixed thoroughly with potting earth some time before using, often works wonders. Basic slag usually answers the same purpose, and generally is better, because of the phosphate which it contains.

It is not proposed to discuss, or even enumerate, the various chemical fertilisers available. Particulars are readily accessible to all interested. The merits of the various mixtures must be judged by each individual. Let the cultivator understand that although about ten chemical elements in suitable forms are essential for all plants it is seldom necessary to trouble about more than three or four of them, because the others are practically always present in sufficient quantities. Given a soil which is in fair condition, it is usually not necessary to trouble about *special* fertilisers other than those containing suitable nitrogenous, phosphatic, and occasionally potassic compounds. Of these, phosphates and potass are retained by nearly all soils, the only danger being the changes to very inert forms. But the nitrogenous will be largely changed from one form to another, in natural sequence, until the nitrate form is reached, when it is available for plants, but *very* liable to loss in drainage. It has been said that he will be the most successful cultivator, all other things being equal, who always has sufficient nitrate for his plants and *none to spare.* This condition can be largely obtained by observing the colour of foliage, abnormally dark green denoting abundant, and a light green deficient, *available* nitrate. Of course, other things often cause the latter appearance. In houses the matter is much more under control than in garden or field, because we may very profitably use the valuable (horticulturally and commercially) nitrate of potash (saltpetre) in small quantities. This might with great advantage be used much more frequently, especially for

forcing Cucumbers and the like, when the border has been well made up with good soil in which has been incorporated such material as basic slag. Similarly, when potting-earth has been well compounded, this fertiliser will be found the most concentrated substance available. Nitrogen in an available form forces *vegetative* growth, an abundance of stem and leaf being quickly produced. An excess may do serious harm by weakening the constitution of the plant, or crowding out others growing close by. Phosphates are particularly necessary to strengthen growth and to form fruit and seed. The phosphates contained in seed the chemist finds to be the constituent which varies least in amount; the seed must have its quota of phosphate. While dealing with the functions of nitrogen and phosphate, we may suggest an important application. Grass lands, such as lawns, are often sorely robbed; continually mown and seldom manured. These may be most economically maintained in good condition by chemical fertilisers, reserving the organic manures for tilled lands. The fertilisers should be judiciously mixed, remembering that the ingredients used will quickly influence the botanical nature of the herbage. Thus, wherever much nitrate or ammonia be applied, relative to the phosphates and potassic compounds, the clovers will quickly die out, but will luxuriate where the opposite condition holds. On tennis and golf grounds and spots upon which there is considerable running, the presence of clovers is undesirable because they make the sward slippery, but on the other parts of the grassplot a fair percentage of leguminous plants is desirable. The required condition may be obtained almost, if not entirely, by carefully compounding mixtures of fertilisers. Every practical cultivator should endeavour to learn how to compound his own mixtures, but admittedly there are many difficulties. There is a decided advantage in purchasing manures in the unmixed condition, say nitrate of soda, nitrate of potash, sulphate of potash, kainit, superphosphate, bone meal, and some one or more of the organic compounds when the markets are favourable. These may then be used separately or mixed as desired. It will be found that no one mixture can possibly be the best for all plants, all soils, and all seasons.

Experiment alone can inform the gardener what he should use. The great importance of experimenting cannot be overrated, but *it must be done cautiously*. If only three or four fruit-trees, Strawberry plants, Cabbages, or plants in pots, placed in a fair position in relation to the bulk, be experimented with—say one in every six or ten plants—they will, if the application be suitable, give results which can be detected without weights and scales, and the lessons learned will be of immense value for future use.

Experiments of this kind cost *very* little, and take very few minutes, and should always be in progress, remembering that soil and aspect differ everywhere. Some experiments now proceeding will illustrate method. A crop of Potatos was being planted in ordinary course. Flower-pots full of different chemical fertilisers were taken out, and when the furrows were open the third from one end had sprinkled up it a mixture of basic slag and kainit. The next row was missed, then a mixture of basic slag and sulphate of potash was applied, again no manure, and then another row had a mixture of steamed bone flour and sulphate of potash

(this was the favourite—the result of former work); other mixtures followed. After the Potatos were planted and covered in, the plot was roughly divided lengthwise into a number of parts and ammonium sulphate spread broadcast over one part, *i.e.* across the furrows. The adjoining strip had nitrate of soda similarly applied after the Potatos were up. The reasons for these differences will be apparent to all students of the principles of horticulture.

The ordinary gardener cannot compound manures to such an extent as is desirable because he has not the technical knowledge. He may make serious mistakes in mixing, but if done on a small scale as advised he will soon ascertain what he can do. We knew a man who, having heard basic slag recommended as a source of phosphoric acid and knowing something of sulphate of ammonia, thought to make a good manure by mixing these two. The fumes of ammonia gave evidence, when too late, of the mistake made. Technical advice should be sought when obtainable, *but not relied upon until proved by experiment* to be sound. A manure *mixture* is almost certain to do some good, because some one or other of the ingredients is wanted.

A single ingredient will usually do most good if judiciously applied, but may be practically valueless otherwise. We may profitably consider the ingredients largely used in proprietary manures:—Superphosphate, bone meal, nitrate of soda, ammonium-sulphate, and other less valuable ingredients. Of these, nitrate is immediately available, and the phosphate of the superphosphate is precipitated and available almost at once. While these are being taken up, the ammonium sulphate is being altered from the unavailable to the available, and in turn the nitrogen and phosphate of the bone meal or other organic manure will become available, the nitrogen here having to be changed into ammoniacal compounds, prior to the final changes to nitrate. A point of some interest may be mentioned here. Nitrates and chlorides, being very soluble and diffusible, pass wherever the water containing them goes. Not so the phosphates and potash: these are quickly absorbed by the soil from the solution, and, in general, the plant roots have to travel to these ingredients. This shows that it is desirable, when practicable, to mix only when needed in order that we may vary the ingredients. Moreover, the season influences the requirements to a large extent.

Potatos, Turnips, and such-like crops, which grow chiefly in the autumn and which receive much intercultivation, do not need an application of nitrate as much as they would at any other season, because, the soil being warm and well aërated, the conditions are very favourable to nitrification. If these crops grew in early spring, when the winter's rain had washed out the nitrates and the coldness of the soil arrested to a large extent nitrification, an application of available nitrate would be beneficial: this is observable in early spring cabbage. A very small quantity of nitrate forces a fine green tender growth which is very liable to injury. On the other hand, mineral manures, other than nitrates, usually give good results when applied to autumn crops which are well intercultivated. Different soils, varying largely even on the same holding, different systems of tillage, and many other matters influence the amount of each ingredient of plant food available for the time being capable of

being drawn by this or that plant from the practically inexhaustible supplies existent in the soil. How far the cultivator will by the sweat of his brow, or the exercise of knowledge and ingenuity, set free the vast stores of accumulated fertility in his soil, whether in the garden, border, or pot earth, and how far he will augment fertility by applications of more fertilisers, must rest with the individual. The personal equation must ever be an important factor in such problems.

One item more. Home resources are very frequently much neglected. Crop residues, road scrapings, house refuse of *all kinds,* made into a heap or compost, in a convenient spot, turned two or three times, and intermixed with lime in some form, kainit or basic slag, will yield good mould which will require but little assistance in the form of chemical fertilisers.

THE ORIGIN AND DEVELOPMENT OF THE CACTUS DAHLIA.

By Chas. Geo. Wyatt.

[September 10, 1901.]

The origin and development of the Cactus Dahlia, the subject upon which I have been asked to speak, is one of considerable interest, not only from its being the section of the great Dahlia family which to-day meets with universal admiration, but as being quite a modern—I might almost say quite an unexpected—development of a flower which has been with us considerably over a century. No one a few years back, on looking at the Dahlia over which our forefathers showed such remarkable enthusiasm some sixty or seventy years ago, would have thought it possible that it could be so transformed into the totally different character represented by a really good Cactus Dahlia of to-day—a flower of extreme beauty, of graceful form, and, I think I am right in saying, of a wider scope of colouring than is to be met with in any other flower in the whole realm of horticulture. And not the least remarkable fact about this transformation is the short space of time in which it has been accomplished, namely, within twenty years. What eccentric forms and colours it will develop before another twenty years are past is the object of much speculation on the part of those who are working amongst Dahlias and are noting the various forms which the new seedlings year by year exhibit.

Before proceeding to consider the origin of the Cactus Dahlia as we have it to-day, I should like to say a few words on the name by which it has come to be known, a name it will be most difficult to alter now, but which everyone must agree is a misnomer and in every way unsatisfactory, especially in the light of future developments. A really good Cactus Dahlia of to-day is most un-Cactus-like, and of course has no affinity whatever to the family of Cacti; so that although I must speak of the flower before us as the "Cactus" Dahlia in order to be understood, I very much wish some inventive mind would give us a better and a more appropriate name, a name worthy of the flower, and under which we might be able to include the newer varieties of diverse form which will be introduced from time to time, and about which I shall have a few words to say later on. Were it not that the word "decorative" has, strange to say, already been applied to the class which, if any, would most appropriately bear the prenomen "Cactus," this name would have been a very good one for the flowers under consideration, since they are in every sense decorative, whilst the at present so-called "decoratives" are the most Cactus-like. Whether we shall ever succeed in exchanging the two names I cannot tell, but if it is to be done the sooner a move is made in this direction the easier it will be to accomplish it. The only other name which occurs to me as at all suitable (other than the exchange I have just mentioned) is the word "British," for it is a notable fact that the development of this particular section has been almost if not entirely British produce, foreign introductions as yet falling very far short of the high standard necessary

for the approval of those who dispense the certificates and awards of merit of the R.H.S. or of the National Dahlia Society. How long this will continue to be the case I am not prepared to say, but the beginning, the most critical stage of the development, has, I repeat, been entirely British.

Coming now to the origin of the Cactus Dahlia, our minds will quite naturally turn to the species *Dahlia Juarezii*, which is universally thought to be the one great forerunner of all the Cactus Dahlias met with to-day. I am quite prepared to admit that, but for the introduction of *D. Juarezii*, the great section we are considering would probably as yet be non-existent; but I hope later on to show that every Cactus Dahlia is not wholly and solely the progeny of *Juarezii*.

When *D. Juarezii* was first introduced to this country, considerable doubt was expressed as to what species it was and where it came from; but, as we shall presently see, it was introduced into Europe in the year 1872, being sent to Holland from Mexico in the autumn of that year. I myself first met with it in France in 1876 under the unsavoury name of 'Etoile du Diable,' the name having, I expect, been suggested to the French mind by its dazzling fiery colour. I little thought then that it was destined to play such an important rôle in the evolution of my old friend the Dahlia, in whose company I had from infancy been reared, and which I often think was the object of quite as much care and solicitude as I myself was, notwithstanding I am an only son. Dahlia-growers of to-day have but little idea what thought and attention were bestowed on Dahlia-growing and Dahlia-raising fifty years ago.

D. Juarezii, then, was first brought into prominence in 1879, when it was figured in the *Gardeners' Chronicle* of October 4, and the following paragraph appeared in the same issue:—

"At one of the recent meetings of the Royal Horticultural Society, considerable interest was attracted to a remarkable Dahlia exhibited by Mr. Cannell under the name of 'Cactus Dahlia.' In the Dahlia as ordinarily seen, the florets are rolled up so as to resemble short quills, but in the present case the florets are all flat or nearly so, strap-shaped, and of a rich crimson colour."

The plants from which these flowers were taken appear to have been introduced from Holland by Mr. W. H. Cullingford, who passed them on to Mr. Cannell.

All doubt as to how the plant came to Europe from Mexico seems to be set at rest by the following letter which appeared in the Dutch Journal *Sempervirens*. The writer, Heer J. T. Vander Berg, of Juxphaas, near Utrecht, says:—

"I was agreeably surprised to see in the *Gardeners' Chronicle* of October 4 an illustration of an old acquaintance of mine, *Dahlia Juarezii*, and still more surprised to see that little is known of the origin of it. In the autumn of 1872 a friend of mine in Mexico sent me a small case containing various kinds of seeds and roots. They arrived in poor condition, the seeds mixed and the roots rotten. However, I kept all that were any good and carefully awaited the result. At last a tender shoot developed itself, which proved to be a Dahlia. Cuttings of this were taken, and the few young plants thus obtained were planted out in June (this would be in

June 1873). They flowered later, and surprised me and others who saw them by their large rich crimson flowers, quite different from all other Dahlias. My catalogue of 1874 will prove the truth of my assertion, and in that catalogue it is mentioned for the first time under the name of *Juarezii*, which name I gave it in honour of Señor Juarez, then President of Mexico. The fact of its having been derived from France is easily understood when I say that I sent one of the leading French seedsmen a great many Dahlia roots and amongst them were some of *Juarezii*. It is a little remarkable that the name Cactus Dahlia should have been used in the *Gardeners' Chronicle*, as in my catalogue of 1874 I said the flowers, when seen at a distance, resembled those of *Cereus* (Cactus) *speciosissimus*."

It still, however, remains a matter of doubt whether *Dahlia Juarezii* was a distinct species reproducing itself tolerably true from seed in Mexico, or whether it was a chance seedling, a natural deviation from and doubling of the old *Dahlia variabilis*, which was introduced from Mexico about a hundred years previously. Personally I incline to the latter idea. The very fact of its being called *variabilis* shows that the plant from the first was—shall I call it fickle-minded, unstable, variable? And with the experience of a lifetime in the raising of Dahlia seedlings and noting the variable character of their progeny, I think nothing is more probable than that successive generations of seedlings under natural conditions, and with none of the Dahlia fanciers of the old school near to throttle the life out of every seedling which presumed to show a flat floret or to differ in one iota from a florist's standard of the old show flower, might very probably have evolved something of the *Juarezii* stamp—a double flower with a long flat floret.

In fact, to proceed with the history of the Cactus Dahlia nearer home, I believe that *D. Juarezii* and its progeny are in themselves not so entirely responsible for the revolution which their introduction brought about as the idea of encouraging the propagation of seedlings having long flat florets, which the introduction of *Juarezii* suggested. In other words, had it been known that varieties having long flat petals would be in demand we might easily have selected such, even before the introduction of *Juarezii*. I know for a fact that, previous to the arrival of *Juarezii*, any seedlings (and I have often seen such) which showed a tendency to produce long flat florets were destroyed—aye, and I might even say that had *Juarezii* itself appeared in the beds of seedlings we were every year growing, it, like the others, would have been ruthlessly torn up and thrown into oblivion.

Do not understand me to say that *Juarezii* and seedlings from it played no part in the evolution of the modern Cactus Dahlia—that is far from my meaning—but that much of the cross-fertilisation which has produced the beautiful flowers we all admire to-day has been with other than the progeny of *Juarezii*. *Juarezii*, no doubt, gave us in cross-fertilisation many of the varieties through which the modern developments have come about, but it gave us, over and above this, the idea of admiring and saving varieties with long florets produced by the variable nature of the Dahlia family, apart altogether from *Juarezii*.

In referring to the improvement—shall I call it the perfecting?—of

the Cactus Dahlia, an omission to mention my own work and the work of my predecessor, the late Mr. Walter Williams, whom so many Fellows of the R.H.S. reckon amongst their departed friends, would savour of a

FIG. 226.—ONE OF THE EARLY FORMS OF CACTUS DAHLIAS.

false modesty. Our firm (Messrs. Keynes, Williams & Co.) had for some forty or fifty years paid special attention to the raising of new Dahlias of the Show, Fancy, and Pompon types, and seedlings to the number of

40,000 and over were planted out every year to select new varieties from; so that directly the idea occurred of encouraging a new and long-petalled type it gave us a splendid opportunity of seeking out and saving those showing a tendency to this character. And to this selection from an enormous quantity of seedlings I attribute very much of the alteration in the type which has been effected. But mention should also be made of others who have contributed very largely to the improvement of Cactus Dahlias; specially would I name Mr. T. S. Ware, Messrs. Cannell, Messrs. Cheal, Mr. Burrell, Mr. Stredwich, Mr. West, and Mr. Turner.

Of the earlier varieties of Cactus and semi-Cactus, as they used to be called, and decorative varieties, of which fig. 226 is a representative, perhaps the best known in 1888 besides *Juarezii* were:—

'Constance,' re-introduced by Pearson about 1883;

'Cochineal,' sent out by Ware in 1884;

'Henry Patrick,' also sent out by Ware;

'Mrs. Hawkins,' another, I believe, of Ware's;

'Zulu,' also one of Ware's;

'William Pearce,' another of Ware's;

Picta formosissima, an old variety re-introduced by Cannell, and 'Empress of India,' sent out by Keynes, Williams.

In 1889 we sent out 'Amphion,' 'Asia,' 'Honoria,' and 'Panthea,' only the first of which, I think, was a seedling from the *Juarezii* family.

In 1890 we planted out the enormous number of 80,000 seedlings, the result of which was seen in our introductions of 1892, as follows:—'Baron Schröder,' 'Kynerith,' 'Lancelot,' 'St. Catherine,' 'Viscountess Folkestone,' 'Countess of Pembroke,' 'Claribel,' 'Dr. Masters,' 'Guinivere,' 'Ione,' and 'Mrs. Arthur Newall.'

But I think the great beginning of the modern form of the Cactus Dahlia dates from the introductions of 1893, the most important of which were: 'Bertha Mawley,' 'Countess of Gosford,' 'Countess of Radnor,' and 'Delicata,' the first three by us and the last by Ware. These, it will be noticed, are still usually classified as "Cactus," whereas all which preceded them have been relegated to the so-called "decorative" type.

At first growers of Cactus Dahlias were content if the flowers were double, having long flat florets, which in many cases were decidedly flimsy. In the years 1890 to 1892 the aim was for the floret to be more irregular, and a curled or twisted floret was thought much of. A description of 'Countess of Radnor' in the *Gardeners' Magazine* of September 10, 1892, is, I think, interesting as showing the idea of a Cactus Dahlia at that date—not quite nine years ago:—

"This new Dahlia represents, I think, the Cactus type in its fulness. It is a beautiful flower, quite free from the bold coarseness that distinguishes the so-called decorative class. The petals, charmingly turned inwards, indicate that it is a true example of the Cactus class, of which the old and familiar *Juarezii* is the great head."

The year 1894 gave us still greater improvements in 'Gloriosa,' 'Lady Penzance,' 'Matchless,' 'Cannell's Gem,' and 'Blanche Keith.'

The year 1895 brought us 'Earl of Pembroke,' 'Harmony,' 'Marquis,' 'The Bishop,' and 'Major Haskins.'

The year 1896 produced 'Mrs. Francis Fell,' 'Mabel Keith,' 'Fusilier,' 'Domino,' and 'Miss Jane Basham.'

The year 1897 gave us 'Starfish,' 'Cycle,' 'Bridesmaid,' 'Cinderella,' 'Harry Stredwich,' and 'Fantasy.'

The 1898 varieties showed a great advance in the beauty and quality

FIG. 227.—'COUNTESS OF LONSDALE.'

of the flowers, and the list of notable novelties is a large one. The principal items are 'Britannia,' 'Arachne,' 'Mary Service,' 'Keynes' White,' 'Laverstock Beauty,' 'Standard-bearer,' 'Stella,' 'Alfred Vasey,' 'Island Queen,' 'Capstan,' 'Eileen Palliser,' and 'Night.'

In 1899 the principal novelties were 'Countess of Lonsdale' (fig.

227), 'Exquisite,' 'Captain Broad' (fig. 228), 'J. F. Hudson,' 'Viscountess Sherbrooke' (fig. 229), 'Lucius,' 'The Clown,' and 'W. Cuthbertson.'

In 1900 we had 'Ajax,' 'Cornucopia,' 'Emperor,' 'Mrs. J. J. Crowe, 'Mrs. Carter Page,' 'Progenitor,' 'Innovation' (fig. 230), 'Mayor Tuppeney' and 'Up-to-Date.'

FIG. 228.—'CAPTAIN BROAD.'

The best of the present year, so far as I have seen them, are 'J. W. Wilkinson,' 'Rosine,' 'J. Weir Fife,' 'Imperator,' 'Lyric,' 'Lord Roberts,' and 'Prince of Yellows.'

Thus far I have traced the history of the Cactus Dahlia as we have it to-day, and would now say a few words on the formation of the flower itself, as it will help us much to note in what way the flower before us differs from the other sections and from the Cactus Dahlia as we knew

it twenty years ago. If we take the bud of any Dahlia which has just begun to open and to show colour, it will be noticed that in a beautifully regular way each separate floret (quite distinct from its neighbour, and which, as a botanist would tell us, is to all intents and purposes a separate flower in itself) has from the first been formed with its two edges folded over and upwards, and generally with its tip or point

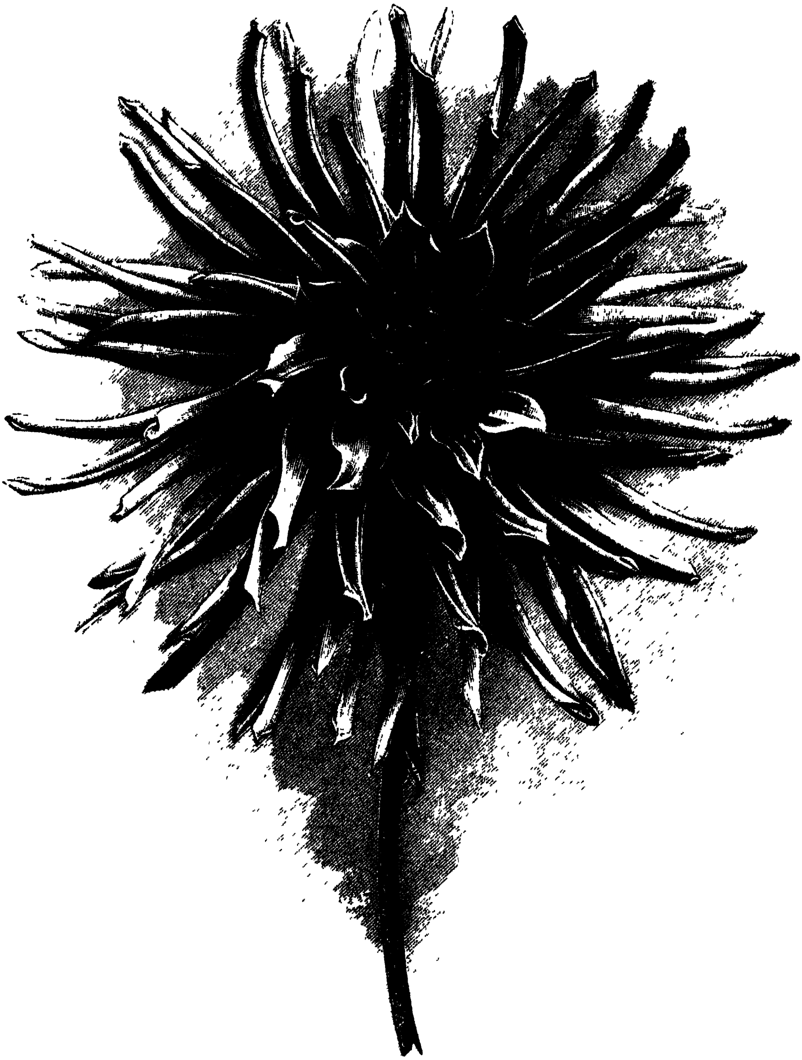


FIG. 229.—'VISCOUNTESS SHERBROOKE.'

bent inwards. Each of these florets is protected by a sheath or bract, which is usually transparent or only slightly tinted with green, and it is this bract which, when the floret has fallen off, protects the seed until it is ripe.' As growth proceeds the floret only increases in size, and, from being folded with its edges inwards, gradually assumes in the case of a single flower a flat or open form down quite close to its base, and the

beauty of a single flower consists in the perfect flatness of the floret of which we are speaking. To form a Show or Pompon these florets are, of course, so increased in number that not only is there one row of florets at the back of the flower, but the inside almost to its very centre is filled with florets in various stages of development, the outside ones developing first. Now, in the case of a Show or Pompon variety, if a floret is taken out it will be seen to be much shorter and fuller in width than in the single

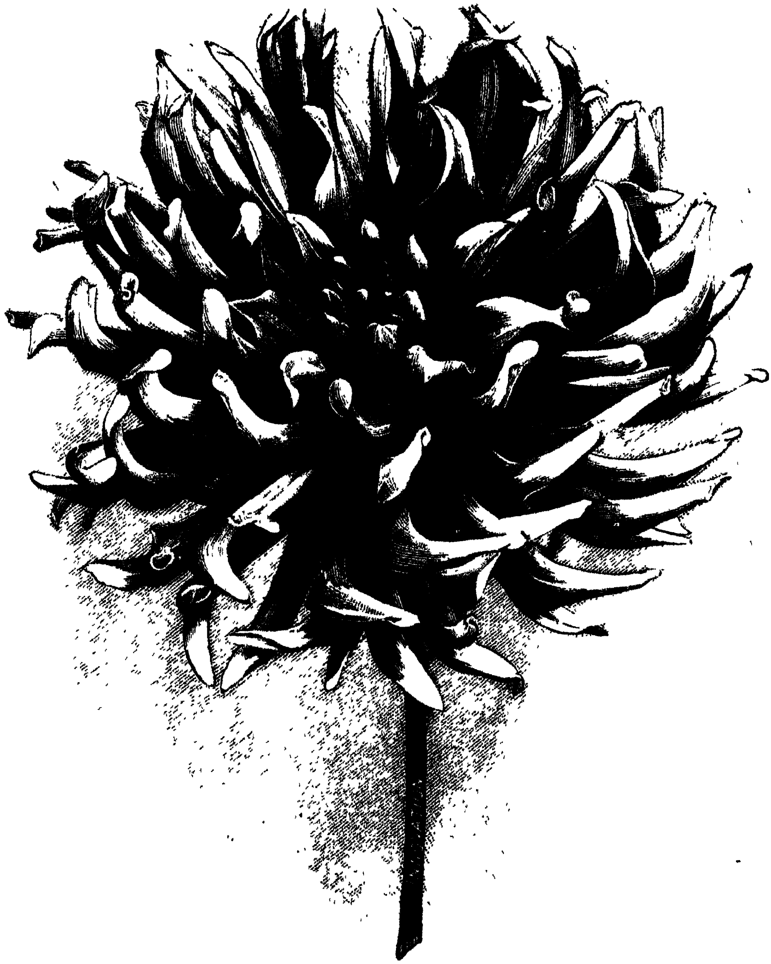


FIG. 230.—'INNOVATION.'

flower, and, instead of opening out flat nearly down to its base, it retains somewhat the shape in which it was formed, only in a rounded instead of a flattened or folded form. It is this which gives us the beautiful shell-shaped petal in the Show and Pompon Dahlias.

In the formation of the Cactus Dahlias the florets are found folded exactly in the same way, but they are very long indeed compared with their width and escape at the edges, forming, in the case of the older

varieties, a flat floret; but in the modern type the edges roll back in the opposite direction from that in which they were formed, making the floret appear much more narrow than it really is, and all the different forms of the Cactus Dahlia owe their beauty to the varied curves and flutings,

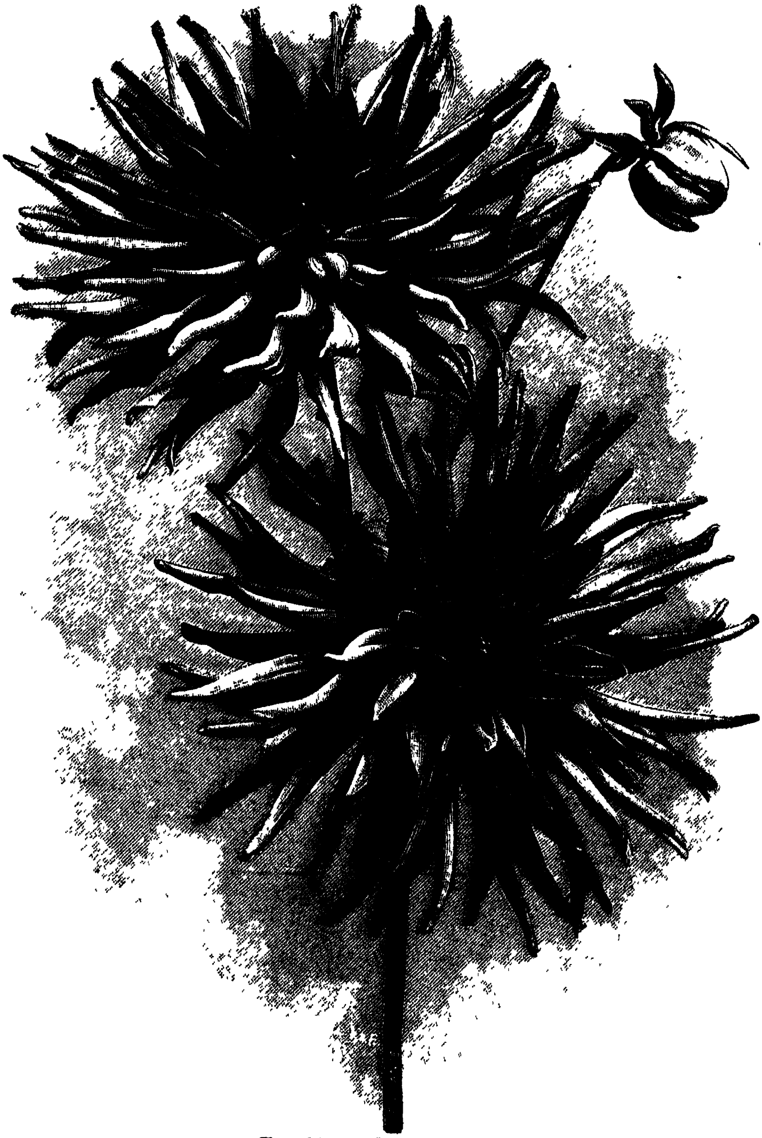


Fig. 231.—'Radiance.'

twists and irregularities into which the florets in their development throw themselves.

I should like here to say something about the shape of the buds of Cactus Dahlias, as they have a decided bearing on the character of the ultimate flower, especially on the centre or undeveloped portion of it. Many admire a flower the centre of which consists of the florets in the

course of development, neatly curved inwards, exactly as is the case with a show flower. These are the varieties the buds of which are flat or button-shaped; and in nearly every case it will be seen there is what must be considered an unsightly break between the florets fully developed and those still developing. Often there will be one row or more of flat florets near the centre, undergoing the change from the folding frontwards to the rolling backwards, and this detracts from the beauty of the flowers and makes them of less value in an exhibition stand; and I think before many years are past this class will have died out.

All the best forms of Cactus Dahlias, and by far the greatest number, have buds formed in the shape of a filbert, with quite a point to them; the florets of such in an undeveloped state are never or very seldom curved inwards, but are gradually unfolded from a straight position. In many of these the fully-developed floret, as its edges bend backward, takes a graceful curved form towards the front, and these, in my opinion, are amongst the most attractive of the modern Cactus Dahlias. But so varied are the different forms now existing that in shape, to say nothing of colour, one variety can scarcely be considered the exact counterpart of another, and it is most difficult to in any way classify them. However, each of the various forms has some advocates. Some, for example, prefer the form in which all the florets are quite straight and pointed, as in 'Charles Woodbridge,' 'Countess of Lonsdale,' 'Ruby,' 'Ethel,' 'Firebrand,' and 'Zephyr,' whilst some prefer the flowers in which the florets are very numerous, the centre ones only being slightly curved, as in 'Britannia,' 'Mary Service,' 'Capstan,' 'Fighting Mac,' and 'Up-to-Date.' There are others who most admire a flower in which nearly all the florets curve inwards, as in 'Night,' 'Mrs. Carter Page,' 'Captain Broad,' 'Laverstock Beauty,' and 'Mrs. J. J. Crowe.' Some, again, prefer those of a graceful but irregular form, like 'Fantasy,' 'Loyalty,' 'Ajax,' and 'J. F. Hudson.' And some like those with a tendency to reflex each floret, as 'Magnificent,' 'Uncle Tom,' and 'Lord Roberts.' Each of these forms, to my mind, has a charm of its own, and I am inclined to think it is just this great diversity of form, quite as much as of colour, which has made the Cactus Dahlia so popular a flower as it is to-day.

As regards future developments I see no reason, having such a diversity of form and colour to work upon, why we should not expect developments totally beyond anything we now have, and in a few years we may possibly have Cactus Dahlias and Chrysanthemums vying with each other to be, in beauty and in size, the Queen of Autumn. I myself have for some years been working a new quilled form, but I have as yet very little to report regarding it.

In several quarters I have heard it intimated that some standard should be set up, either by the R.H.S. or by the National Dahlia Society, as to what a good Cactus Dahlia should be in form. I have devoted much thought to the subject, and am decidedly of the opinion that it would be most unwise to attempt to do this. As I have already said, diversity of form helps to make the Cactus Dahlia popular, and whichever of the various forms were chosen or adopted as the standard, it would inevitably throw out a host of beautiful flowers which others most admire, and would probably cause a curtailing of that universal interest which it seems the Cactus Dahlia is destined to create.

ROSES FOR AUTUMN BLOOMS.

By ARTHUR WILLIAM PAUL, F.R.H.S.

[September 24, 1901.]

THE era of autumn-blooming Roses may be said to have commenced with the introduction of the Bengal or Chinese Rose (*Rosa indica*) from the East at the end of the eighteenth century (1789), and it is to this Rose and its descendants—direct or hybridised with other species—that we owe the best autumnals of to-day. It is true that the Musk Rose and perhaps one or two other late-flowering species were already in English gardens, but the flowers were comparatively insignificant and only fitfully produced. The Roses of the West were essentially summer flowers; and hence by the earlier poets and painters they are linked with sentiments and associations of early summertide. Shakespeare makes one of his characters say:

> At Christmas I no more desire a rose
> Than wish a snow in May's new-fangled shows,
> But like of each thing that in season grows.

At the present time, however, it is no unusual thing to pluck blooms of 'Gloire de Dijon,' 'Madame Lambard,' and other favourite Roses at Christmas from plants out of doors on walls and other sheltered positions in the garden.

Without doubt, ever since the Rose enjoyed the serious attention of the horticulturist, Roses in autumn have been appreciated, especially in large gardens, coming as they do at a time of year when so many of their owners are in residence, with the leisure to admire the beauties of the surroundings of their country homes. In 1812 was raised, in the gardens of St. Cloud, near Paris, a beautiful crimson Rose, named by the raiser 'Rose du Roi.' This Rose I have always regarded as the first of the Hybrid Perpetuals, a group which, having increased in variety, held almost undisputed sway from the middle till nearly the close of the last century. In the first edition of "The Rose Garden," published in 1848, we find enumerated and described 188 varieties of Bourbon Roses, 145 varieties of Tea-scented Roses, 106 varieties of Hybrid Perpetual Roses, upwards of 100 varieties of Chinese Roses, and many other varieties of autumnal-flowering classes; but when representative groups began to be exhibited at the meetings of this Society, some eight or ten years since, it was rare to find admirers of the national flower who had cultivated it with this especial object in view. Since that time, however, the number of really handsome autumn-blooming Roses has largely increased, and to what a state of perfection in beauty of form and colour they have attained may be judged of from the collections which have been exhibited from time to time in this hall. It may be said that the long and warm summers of the last few years have greatly favoured the development of the autumn flowers, especially in the Chinese, Tea-scented, and Hybrid Tea-scented sections; indeed on October 10 last year these particular

classes at Waltham Cross were as full of flower as in the height of summer, whilst the quality of the blooms was extraordinarily good. But, making due allowance for these especially favourable climatic conditions, we are certainly much better off in respect of autumn-blooming Roses than we were twenty years ago, and I think the time has come for June to share with September her proud pre-eminence as the "month of Roses," and that there will not be wanting poets of the future who will sing the charms of the Roses of the autumn, those chaste and richly-hued blossoms which so gratefully prolong the season of the queen of flowers, and maintain the garden gay with their soft and glowing colours until the icy hand of winter finally closes in upon us.

As indicating the large measure in which we are indebted to the Chinese Rose for the best autumnals of to-day, it may be remembered that, in addition to the many beautiful varieties of the original type that we possess, the Tea-scented Rose and its varieties (*R. indica odorata*) are a group of the same species, whilst to the union of the Tea Rose with the Hybrid Perpetuals (and perhaps a few varieties of other species) we owe the comparatively recent class of Hybrid Teas which are so deservedly popular. Again the Musk Rose crossed with the Chinese (their progeny in some cases again crossed with the Tea Rose) has given us the lovely cluster-flowered Noisette Roses; the Chinese Rose crossed with the 'Four Seasons' or Damask Perpetual has given us the Bourbon Roses which were so popular fifty years ago, and which still furnish some excellent autumnals, whilst the beautiful Dwarf Polyantha Roses so valuable for massing and for edgings in the autumn Rose garden are supposed to owe their origin to the crossing of the Chinese or Tea Roses, with the stronger growing summer-flowering Multiflora Roses. Even in some of the best autumn-blooming Hybrid Perpetuals it is not difficult to imagine traces of Chinese or Bourbon blood either directly or through the Damask Perpetuals. The earlier varieties of the Tea-scented Rose were no doubt too delicate for general planting out of doors, but of late years, thanks to judicious cross-breeding and selection, a great improvement in this respect has taken place, and, although some of the more recent introductions may be lacking in the grace of habit and delicacy of perfume of the earlier varieties, they more than make amends for decorative purposes by their hardier constitution, their greater variety and richness of colour, and their excessive freedom in blooming.

Next to the Chinese Rose and its variations and descendants above indicated, the most important class as autumnal bloomers are the Hybrid Perpetuals. A few years ago the varieties of this class ranked very highly among autumn Roses, but it must be admitted that they have been somewhat eclipsed of late by the Teas and Hybrid Teas. As a class, however, it is still justly held in high esteem for late flowering, for although many of its varieties cannot be depended upon to give sufficient flowers in autumn to produce any great effect in the garden, such favourites as 'Alfred Colomb,' 'Ella Gordon,' 'Fisher Holmes,' 'Mrs. John Laing,' and others are of great excellence.

Among the minor classes of Roses, several of the Rugosa Roses are good autumnals, and they are further valuable for their extreme hardiness. They successfully withstand severe frost, and are often found to thrive

well in the neighbourhood of large towns and under other unfavourable conditions of soil and climate. Several of them also possess an additional attraction in the showy heps which succeed the flowers. Other good autumnal blooming-species are the Microphylla and Macartney Roses, which, however, are rather tender and succeed best with the protection of a wall; the Perpetual Moss Roses, which as yet do not appear to have attained to the popularity enjoyed by their summer-flowering relatives; the Perpetual Scotch Roses, one of which, the 'Stanwell Perpetual,' forms strong hardy bushes covered with deliciously-scented rosy-white flowers in autumn; the Musk Roses, whose clusters of double flowers remind one of the Ayrshire and other climbing cluster Roses of summer; and the Damask or Portland Perpetuals, which were once exceedingly popular, but have now almost passed out of cultivation. The single-flowered *Rosa Wichuriana* is a beautiful autumnal bloomer, but the hybrids of it introduced at present do not preserve this trait. The *Clynophylla duplex* should also not be lost sight of: it has rosy-white flowers with distinct downy foliage.

Passing allusion may also be made to the autumn flowers which are occasionally produced by varieties whose nature it is to bloom once only, in early summer. The Briar Rose *Harrisonii* has been known to flower at Waltham Cross in autumn, and I have heard of the same occurrence elsewhere, but I never knew its autumn-blooming character to be fixed by propagating from the flowering wood, although I know the attempt has been made. Last year, also, I noticed in several places some of the summer-flowering climbing roses of the Ayrshire and Evergreen classes giving a second crop of flowers in September and October, but I do not imagine that this habit could be perpetuated. It was no doubt due to the long warm summer, broken by a cool wet week at the commencement of August, and followed by another spell of warm weather, which caused the plants to start into a second growth, and to produce flowering shoots from already well-ripened and developed eyes. We also read in the papers last January of an autumn-blooming form of the 'Crimson Rambler,' which I think may be referable to the same cause, although, of course, this is conjectural.

I propose now to make a few remarks on the general cultivation of the particular classes of Roses specially valuable for their autumn-flowering qualities, and I shall then submit the names of some of the best varieties of different habits of growth and of various shades of colour.

The Chinese Roses of all kinds, the dwarf-growing Tea-scented Roses, and such of the Hybrid Teas as approximate in nature and habit to the dwarf Teas, thrive best in moderately light soils. Light loam suits them well, and they will flourish even in peaty soil. It must be borne in mind that they are susceptible to severe frost, and when such appears to be imminent it is well to draw some of the surrounding soil towards the collar of the plant so as to keep its heart uninjured. It is also well to place pieces of cut evergreen or other litter loosely among the branches of the plants. Severe pruning never has the effect of destroying the flowering of these classes (although, of course, the larger the plants can be grown the finer will be their effect in the garden), so

Fig. 232.—Messrs. Wm. Paul & Son's (Waltham Cross) Group of Autumn Roses at the Drill Hall, September 24, 1901.

that no hesitation need be felt in removing in spring any wood that appears to have been injured by frost or moisture during winter. There should be no stint of nourishment in the soil, as the strain on the plants in the case of varieties so continually growing and flowering is very great. The beds or borders should be mulched every November with rich manure, which may be turned in with the soil in spring. In order to develop and improve the autumn crop of flowers (although the greatest success in this respect will always depend largely upon the choice of the most suitable varieties), something may be done to assist Nature by attention to the plants after the first flowering is finished in July. A period of rest is highly beneficial, indeed necessary, after which a little summer pruning and thinning is advisable, and the pinching back of any gross shoots as they appear will tend to equalise the growth and strength of the remainder of the plant, with corresponding advantage to the coming crop of flowers. Especial attention should be given to any point that will assist the second growth of the plants when it commences, as it is upon the young shoots that the flowers are produced. Keeping the ground well hoed, and giving the plants occasional waterings with manure water if the weather is dry from the middle to the end of August, will be of assistance to them, and will improve the quality of the autumn flowers. The system of culture for the Climbing Teas and the Noisette Roses is similar to that recommended for the Chinese and dwarf Teas, excepting that greater care should be taken in the protection of the wood in winter, and pruning in spring should consist in leaving the best of the strong shoots of the previous year as long as possible, as these produce the best flowers. The Hybrid Perpetuals, the Bourbons, and the Rugosa Roses will succeed in a stronger soil, and, being by nature hardier and better able to resist frost, they will require little attention in winter, although, should the weather be very severe, some slight protection may be serviceable in the case of the two former groups. The pruning in spring will be at the option of the cultivator, according to whether a large number of moderately-sized flowers or a smaller quantity of larger ones are desired for the first crop—long-pruning securing the former and close-pruning the latter result. The summer treatment for the improvement of the autumn flowers will be as recommended for the other classes. Mulching with rich manure in early winter is very desirable. The dwarf Polyantha Roses require the same treatment as the Chinese, but as they are generally used for edgings, or other positions where a dwarf habit is desired, pruning should be close. The best varieties of this group are such free autumnal bloomers that they need no special care or attention for the development of the second crop of flowers.

Coming now to an enumeration of the best varieties of Roses of different classes for autumn blooming, I think the most serviceable way of dealing with this part of my subject will be to group them according to their habits of growth, specifying in each group the best varieties of each shade of colour. I would here take the opportunity of strongly advocating, whenever possible, the system of planting Roses in beds or masses—small or large, according to the space available—of a single variety rather than mixing a number of varieties in one bed. Although a Rose under any circumstances is an object of beauty, and it is

rare to find an unpleasing association of colour in the Rose-garden, by the system of mixed planting the different habits of growth of the different varieties are apt to interfere with the general effect, and when once the bolder system of planting masses of one variety has been tried the superiority will be admitted without question. It is also desirable, when possible, to lay out a Rose-garden on grass, and a background of evergreen or other foliage adds greatly to the general effect. Where Roses in autumn are especially desired, dwarf plants will predominate in the Rose-garden, but standards may be used in special positions, and the stronger growing varieties of autumnals may be planted as single specimens to form pillars or large bushes, or they may be massed in the centres of large beds. For our purpose the different varieties of Roses seem to fall naturally into four groups, namely—

1. Dwarf-growing ones for low masses or for edging.
2. Varieties of moderate growth.
3. Varieties of vigorous growth.
4. Varieties of semi-climbing or climbing habit.

It will be understood that the habits of growth and grouping of colours are approximate only; soil and locality will affect the former, whilst colours, especially in the Tea and Hybrid Tea sections, are often difficult to classify; the autumn shades are also often deeper than the colours of the same plants in summer. I think, however, the following grouping will be generally found correct:—

Commencing with dwarf-growing varieties suitable for low masses or for edgings to beds, the Polyantha varieties—'Anne Marie de Montravel' (white), 'Eugénie Lamesch' (coppery yellow), 'Gloire des Polyantha' (bright rose), 'Léonie Lamesch' (coppery red), 'Mignonette' (pink), and 'Perle des Rouges' (crimson) are excellent. Other good ones for this purpose are the varieties of the crimson Chinese Roses, especially 'Cramoisie Supérieure,' 'Eugène Beauharnais,' and 'Fabvier.' The Chinese Roses 'White Pet' and 'Red Pet' are also suitable. The miniature China or Lawrenciana Roses are a little delicate, but are excellent for the purpose where they will thrive.

Coming next to the moderate-growing ones, we have in the Chinese, Tea-scented, and Hybrid Tea-scented sections a wealth of varieties of the greatest excellence for autumn-blooming, and it is scarcely possible to do them justice within the limits of this paper. I shall therefore mention only some of the very best. 'Aurore,' 'Madame Eugène Résal,' and 'Madame Laurette Messimy' are a trio of Chinese Roses producing flowers of almost indescribable tints of pink and rose-colour mingled with shades of yellow and copper, while the peerless 'Queen Mab,' with its soft rosy-apricot blossoms, is one of the gems of its class. Other valuable Chinese Roses are the 'Common Pink,' known also as the 'Monthly Rose' from its persistent habit of flowering; 'Ducher' (white); 'Duke of York' (variable red and white flowers always beautiful); 'Irene Watts' (salmon-pink); 'Jean Bach Sisley' (silvery rose); and 'Maria Sage' (full pink). To these may be added the Bourbon varieties 'Armosa' with its bright pink blossoms, and 'Mrs. Bosanquet' (white), and the Tea Rose 'Princesse de Sagan' (deep velvety crimson), all three of which have many of the characteristics of the Chinese Roses. The Polyantha variety

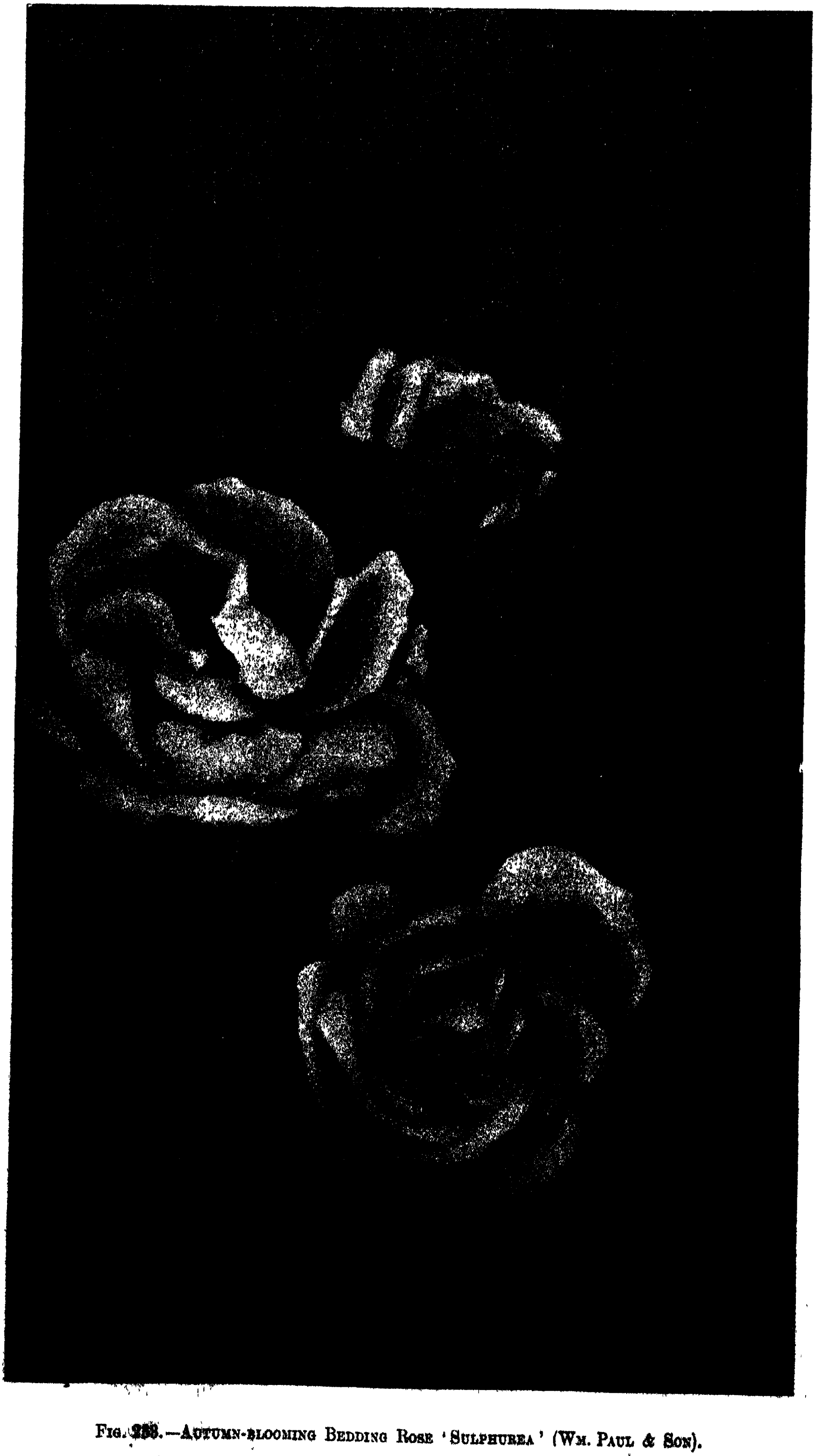


FIG. 233.—AUTUMN-BLOOMING BEDDING ROSE 'SULPHUREA' (WM. PAUL & SON).

'Perle d'Or' (golden buff) and the Bourbon 'Souvenir de Malmaison,' with its blush flowers, are also good. Among the Teas and Hybrid Teas I would particularise:—White, or nearly white, 'Antoine Rivoire,' 'Enchantress,' 'G. Nabonnand,' 'Hon. Edith Gifford,' 'Madame Cadeau Ramey,' 'White Lady,' and 'Yvonne Gravier'; straw-colour and yellow, 'Madame Chedane-Guinoisseau,' 'Madame C. P. Strassheim' (extraordinarily free in blooming), 'Madame Hoste,' 'Marie van Houtte,' and 'Sulphurea'; orange-yellow and buff, 'Alexandra,' 'Goldquelle,' 'Madame Charles,' 'Madame Falcot,' 'Safrano,' 'Souvenir de Catherine Guillot' (magnificent), and 'Souvenir de William Robinson' (tinted); pink and rose-colour, 'Boadicea,' 'Grand Duc Adolphe de Luxembourg,' 'Grande Duchesse Anastasie,' 'Madame Jules Grolez,' and 'Rainbow'; salmon-rose and red, 'Empress Alexandra of Russia,' 'Ferdinand Jamin,' 'Madame Abel Chatenay,' 'Madame Lambard,' 'Morning Glow,' 'Safrano à fleurs rouges,' 'Salmonea,' and 'Souvenir de J. B. Guillot'; full red, 'Comtesse Festetics Hamilton' (a magnificent metallic shade of colour), 'Francis Dubreuil' (deep red), 'General Schablikine,' 'Marquise Litta,' 'Marquise de Salisbury' (very brilliant), 'Marie d'Orléans,' and 'Papa Gontier.'

The third group, varieties of vigorous growth, will consist of a few of the stronger-growing Tea Roses and Hybrid Teas, together with the Hybrid Perpetuals and Bourbons. Here also we have a very large selection, from which the following appear to me some of the best for autumn flowering:—White and nearly white, 'Augustine Guinoisseau' and 'Viscountess Folkestone'; yellow, 'Madame Pernet Ducher'; pink and rose-colour, 'Aurora,' 'Belle Siebrecht,' 'Camoens,' 'Caroline Testout' (extra fine), 'Duchess of Albany,' 'Grace Darling,' 'La France,' 'Madame Wagram,' 'Marie Finger,' 'Marquise de Castellane,' 'Mrs. John Laing,' and 'Victor Verdier'; red and crimson, 'Alfred Colomb,' 'Comte de Raimbaud,' 'Corallina' (extra fine), 'Ella Gordon,' 'Exquisite,' 'Fisher Holmes,' 'Gloire des Rosamanes,' 'La France de '89,' 'Louis van Houtte,' 'Madame Isaac Péreire,' 'Madame Victor Verdier,' 'Ulrich Brunner fils,' and 'Victor Hugo.' Of these last 'Fisher Holmes,' 'Louis van Houtte,' and 'Victor Hugo' are of somewhat less vigorous growth than the others. To this group also belong the Rugosa Roses, the Perpetual Moss, the Perpetual Scotch, and the *Clynophylla duplex*: these form strong bushes, but from their distinct foliage and general appearance should be planted by themselves. Of the Rugosas, good autumnals are the single red and white, 'Belle Poitevine' (rose-colour), 'Blanc double de Coubert' (white), 'Fimbriata' (fringed white flowers), and the Hybrid 'Mme. Georges Bruant.' This last is one of the most beautiful white Roses in existence, the flowers being of the purest white, and produced in great abundance both in summer and autumn.

In the fourth group, varieties of semi-climbing and climbing habits, we have the best varieties for forming large single bushes or pillars, or for covering arches, or even for planting in masses where bold grouping is desired. We have not quite so large a choice of good autumnals here as in the previous groups, but the following are all excellent:—White, 'Madame Alfred Carrière'; yellow, 'Céline Forestier,' 'Gustave Regis,' and 'Billiard and Barré' (very rich); buff and coppery tints, 'Desprèz à

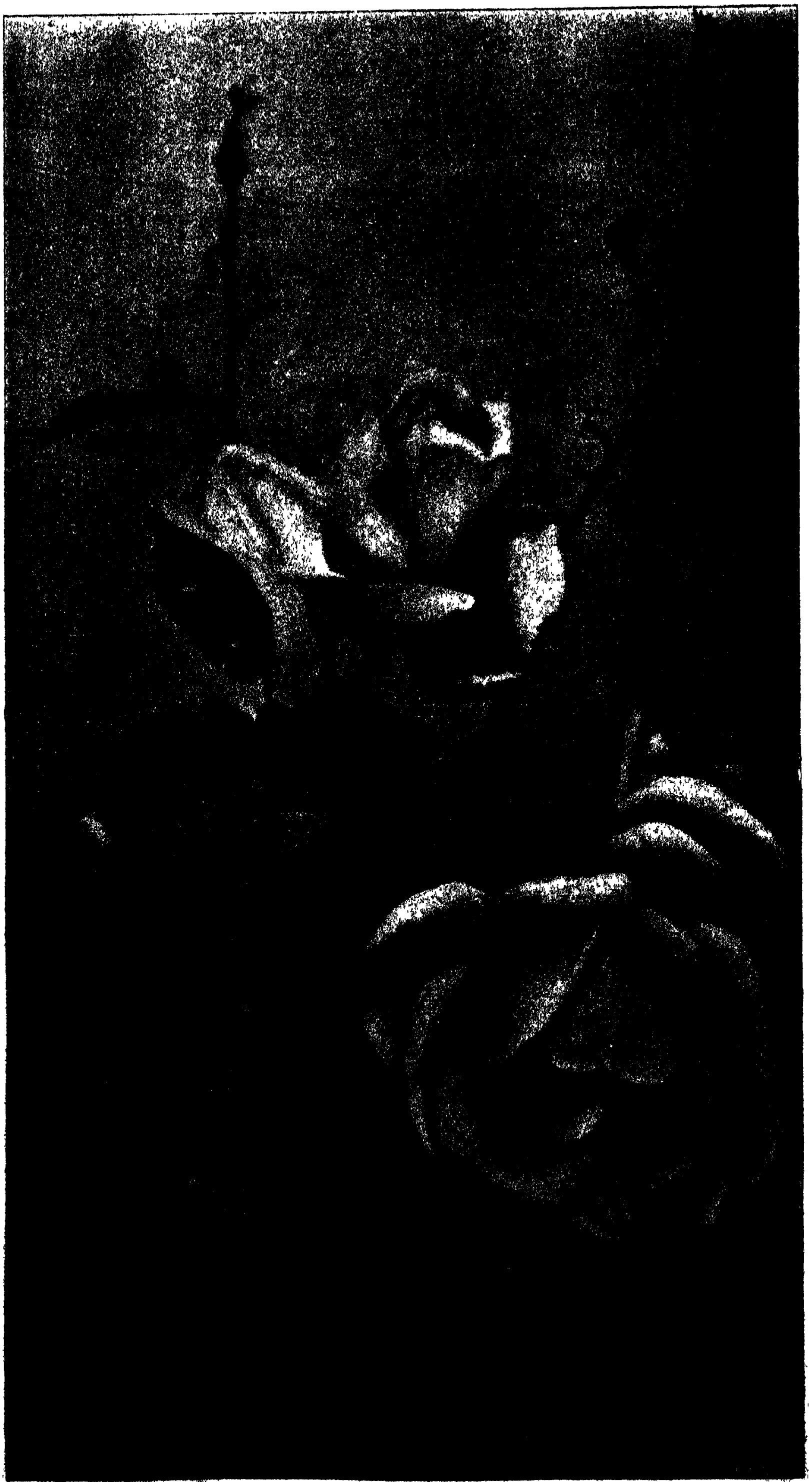
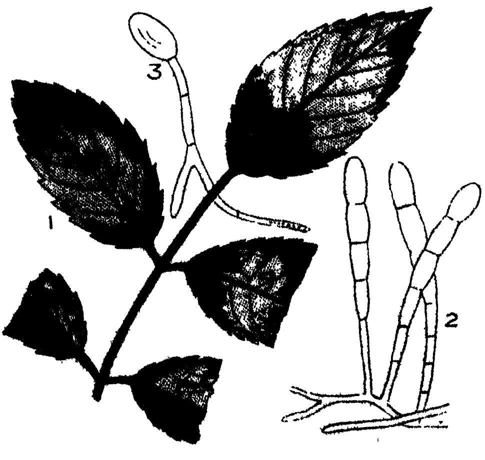


FIG. 234.—AUTUMN-BLOOMING BEDDING ROSE 'CORALLINA' (WM. PAUL & SON).

fleurs jaunes,' 'Gloire de Dijon,' 'Kaiserin Friedrich,' 'Madame Chauvry,' 'Madame Moreau,' and 'William Allen Richardson'; pink and rose-colour, 'Pink Rover' and 'Climbing Belle Siebrecht'; crimson, 'Deschamps,' 'Fellemberg,' and 'Gruss an Teplitz.' The last named is one of the most striking Roses of recent introduction, and cannot be too highly recommended for the richness and brilliancy of its colour, as well as for the extraordinary profusion in which its flowers are produced in autumn. The introducer informs me that it was the result of three consecutive crossings; in the first instance 'Sir J. Paxton' (Bourbon) was crossed with 'Fellemberg'; the offspring of this union was then crossed with 'Papa Gontier,' and the progeny was again crossed with 'Gloire des Rosamanes.' As a creeping or trailing variety for banks and mounds, *Rosa Wichuriana* is excellent, its pure white star-like blossoms contrasting well with the bright grass-green foliage.

It is satisfactory to know that, notwithstanding the rich choice of materials for the autumn Rose garden that are already in existence, the production of new varieties of pronounced autumn-blooming characteristics is still engaging the attention of hybridisers, and valuable new shades of colour, as well as distinct departures in style of flower and habit of growth, may be looked for in the future. In this latter connection I may mention Mr. Pernet-Ducher's interesting hybrid 'Soleil d'Or,' a cross between the 'Persian Yellow' and the Hybrid Perpetual 'Antoine Ducher.' This Rose, flowers of which have been seen at the meetings of this Society during the past spring and summer, may be considered to be the first of a race of perpetual or autumn-flowering Briar Roses, and it is to be hoped that the raiser may have further introductions of the same race to follow. I also have great hopes of the varieties that are being raised at Waltham Cross from the free-blooming varieties so largely grown in the South of France crossed with the Chinese varieties. These have already given us such fine autumnals as 'Corallina' (fig. 284), 'Enchantress,' 'Queen Mab,' 'Salmonea,' and others, and several other seedlings of great promise have been exhibited from time to time. The enthusiasm of raisers of new Roses is keenly alive to any preferences on the part of the public in all that pertains to their favourite flower, and now that due appreciation of autumn-flowering Roses is being manifested it may be relied upon that the raisers will be found equal to producing all that is required of them.



FRUIT AND FLOWERS IN QUEENSLAND.

HALF an hour's stroll in the grounds of the Acclimatisation Society at Brisbane will secure an inspection, amongst others, of the following:—

Strawberries, imported from England, France, the United States, and New Zealand, growing alongside Pineapples which have come from Florida, the West Indies, and Singapore; also Bowen Park seedling-plants of both Pines and Strawberries; the whole in full fruit.

English and Himalayan Blackberries, just through with their spring and early summer crop, standing within a stone's-cast of Mangos from Bombay and the Mauritius, and a Custard Apple from Brazil, all promising a satisfactory harvest for the coming mid and late summer.

Just on the margin of a large patch of stall Sugar-canes, consisting mostly of Bowen Park, West Indian, and Demeraran selected seedlings, can be seen Rock and Musk Melons, maturing on the same strip of land that ripened Tomatos during the recent mild winter, and which will probably be called upon again directly to carry an early winter crop of Cauliflowers.

The filling of one section of the grounds is suggestive of an extensive itinerary, owing to flourishing examples of the following coming under review:—

Rhubarb from Siberia, English Apples and French Lavender, Spanish Chestnuts and Italian Olives, a Mulberry from Constantinople, Smyrna Figs, Persian and Soudanese Date Palms, Henna from Egypt, Coffee and Castor Oil from Arabia, a hedge of Kai Apples from Cape Colony, Jackfruit and Tamarinds, Teak and the Toddy-palm from India, Cinnamon from Ceylon; and many East Indian representatives, such as Ginger, Croton Oil, Patchouli, Nux Vomica, and Rice; *Arenga saccharifera* from the Philippines, Litchi-litchi and Tea from China. Central Asian Buckwheat and Japanese Cumquats and Persimmons, California Redwood, *Rondeletia* and *Monstera deliciosa* from Mexico, Limes from Tahiti, Taro from the South Seas, Central Australian Saltbush, Flax from New Zealand, Maté from Paraguay, and Green-heart from British Guiana, with many plants from intervening portions of South America, including Cocaine, Tobacco, Guavas, and Tapioca; Granadillas, Logwood, Guttapercha, and Mahogany from quite tropical and Central America, Allspice and Alligator Pears from the West Indies, and Pecan Nuts from Texas.

A flower border in the same grounds further emphasises the lesson, for in it, in their season, can be seen, in splendid flower, Daisies and Hibiscus, Ranunculus and Frangipani, Snowflakes and *Ipomœa Horsfalliæ*, Jonquils and Gardenias, Larkspur and Poinsettias, Geraniums, Fuchsias, Hydrangeas, Wallflowers, Sweet Peas, Dahlias, Freesias, Chrysanthemums, Hollyhocks and English Ivy, along with Azaleas, various Orchids, Allamanda, Gelsemium, and the Rangoon Creeper.

Without entering the shelter and glasshouses—wherein it is usual to

protect plants designed for the tropical North, such as Cocoa and Vanilla—and passing the packing shed, through which may be seen in the winter time such plants as Cherries and other stone fruits destined for the elevated inland portions of Southern Queensland, should further evidence be required to carry conviction, one minute's longer stroll over a sward composed mainly of tropical Buffalo Grass and English Clover will take the visitor to a pond within which, flanked on one side by Burmese Bamboos and on the other by a Weeping Willow, can be seen growing from seeds ripened in the open air, and soon now to be in full bloom together, the British white Water-lily, culled originally from a tiny Welsh streamlet, and the giant Brazilian *Victoria regia* from the mighty Amazon.

BANANAS.—The area under Bananas was greater in the past than in the previous year by 413 acres, but the yield has been considerably less. The area under this crop in 1900 was 6,215 acres, as against 5,802 acres in 1899, the district showing the principal increase being Cairns, with 652 acres greater area in 1900 than in the previous year. Singularly, this district showed a decrease for 1899 as compared with 1898, so that some additional land must have been put under this crop during 1900, probably new land, just cleared, which always yields the best returns under Bananas. The total production in 1900 was 2,321,108 bunches.

PINEAPPLES.—The area of ground under Pineapples was less for 1900 than for 1899, the areas being 939 acres, yielding 424,835 dozen, in 1900, against 994 acres, yielding 401,692 dozen, in 1899; so that whilst there was a reduction of 35 acres there was an increase in the yield of 23,143 dozen.

In addition to yielding in large quantities a product that under careful cultivation is one of the most delicious of all fruits, from the leaf of this plant, either in its wild or its cultivated state, a fibre may be obtained surpassing flax for strength, fineness, and glossy appearance. Their relative strengths were found to be as 26 is to 35; it is also found to possess special qualities for rope-making, it being a good damp-resistant; and from the fineness of its fibre it is considered by some experts that it would offer special advantages for mixing with cotton or wool. As the plant grows so freely in Southern Queensland it is possible that a little investigation might lead to its further utilisation in this direction.

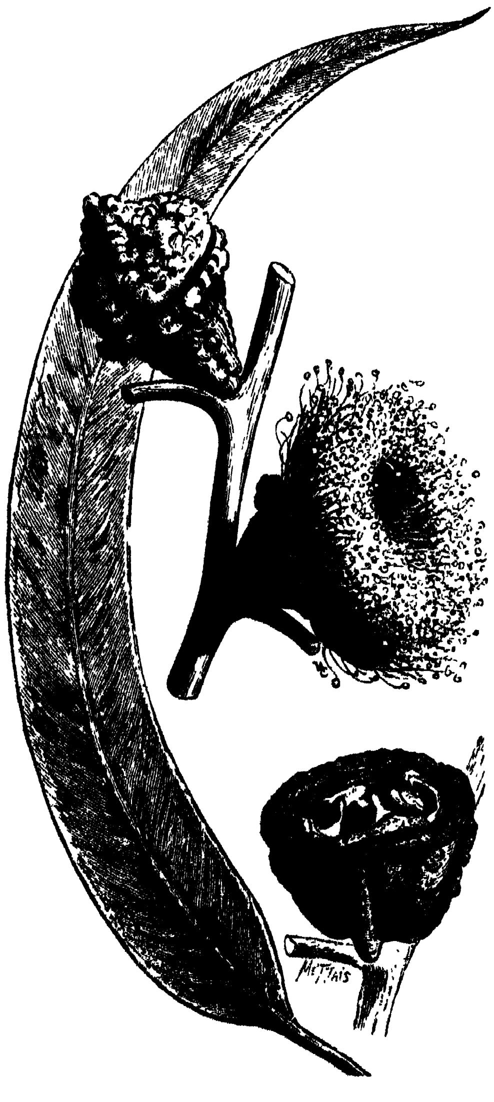
ORANGES.—A satisfactory increase is returned under this heading for the past as compared with the previous year, both in area and yield. For 1900 there were returned 2,882 acres, yielding 2,041,068 dozen, against 2,324 acres, yielding 1,420,839 dozen, in 1899, being an increase of 558 acres and 620,229 dozen in yield.

The area of productive trees was 2,045 acres, and of non-productive, 837 acres.

MANGOS.—A good steady increase was shown in the area under this fruit for the past as compared with the previous year, the area for 1899 being 245 acres, returning 191,074 dozen, which increased in 1900 to 411 acres, yielding 277,444 dozen. Of this area 349 acres were productive, whilst 62 acres were non-productive, not having yet come into bearing.

All the northern portion of the State on the seaboard seems to be well adapted to the growth of this fruit, which can be produced there in any

required quantity, but the drawback seems to be the difficulty of finding a suitable market. It is quite true that much of the fruit grown and sent to market is from trees bearing inferior Mangos, and no one would readily acquire a taste for this fruit if only the fibrous varieties with strong unpleasant flavour were presented for their use. But there are Mangos of most delicious flavour, and free from fibre, which can be grown as easily as the worthless varieties; and if these are properly gathered and packed they should be saleable in any market. The total production in 1900 was 277,444 dozen.



SPOT DISEASE OF THE VIOLET.

Condensed by Dr. Cooke *from a Memoir by* P. H. Dorsett, *U.S. Department of Agriculture, Bulletin No.* 23, *Washington, November* 1900, *with* 7 *plates.*

This memoir declares this disease to be one of the most widespread and destructive maladies known to attack the Violet. The cultivation has been abandoned in many districts of the country on account of its ravages. Five or six years ago 50,000 to 75,000 square feet of glass near Alexandria, Va., were devoted to the cultivation of the Violet, and now on account of the disease the industry has been practically abandoned.

This spot disease (*Alternaria Violæ*, G. & D.) will attack the plants at any stage of growth. Plants making a vigorous but soft and succulent growth are most subject to this disease. It may occur on any portion of the plant aboveground, but causes most damage on the leaves. Its first appearance is made by small circular, yellowish-white spots on the leaves, from a size scarcely perceptible to the naked eye to $\frac{1}{32}$nd of an inch diameter, surrounded by a narrow rim of discoloured tissue. Sometimes these spots spread until they occupy the entire leaf. More frequently the leaf is attacked at a number of different points, which may coalesce. The majority of the spots are usually free from fungus spores, but spores are produced in abundance after the leaves have been kept in a saturated atmosphere for from twenty-four to forty-eight hours. The spores are borne in chains, on darkish brown threads, which rise from the diseased surface. They break away from their attachment and separate easily, so that they can be carried by currents of air and transported to healthy leaves. These spores, or conidia, are club-shaped or flask-shaped, divided by transverse, as well as vertical septa, so as to be muriform, 40 to 60 mm. by 10 to 17 mm., somewhat olive in colour.

Details are given of a number of experiments made by inoculating healthy plants with these fungus spores, and thereby producing the disease.

It is declared that at present no effective remedy for this disease has been found, when it has gained a foothold. The usual sprayings with fungicides have produced little or no effect. The only suggestions made are in favour of prevention rather than cure by giving careful attention to the production of vigorous, healthy plants, in preference to any attempt to check the trouble after it has once gained a hold.

Endeavour to secure plants of ideal development. Grow the plants under conditions necessary for producing vigorous, healthy growth, and protected from conditions likely to induce disease. Keep the houses or frames clean, sweet, and devoid of all rubbish likely to harbour vermin or disease. Propagate only from healthy, vigorous stock at the most favourable season. Select each spring none but perfectly healthy, vigorous plants, from the rooted cuttings, for planting in the houses or frames. Old plants are sometimes carried over, but they are not so reliable as the young plants, and much more liable to all kinds of

disease. Keep the plants clean of yellow, dead, or dying leaves, being careful to destroy them after removing them from the plants. Keep the plants free from insects and other animal pests. Give careful attention to ventilating, heating, and shading the frames, and also to watering, cleaning, and cultivating the plants. Renew the soil each season before setting the young plants by removing eight to twelve inches of the surface soil and replacing it with that freshly prepared. Set the young plants early in the spring in the beds where they are to remain for the season, so that they may get well established before the hot dry weather of summer makes its appearance.

FURTHER REPORT ON VIOLET LEAVES.

By Dr. Cooke, M.A.

On the first occasion there was a large supply of leaves, but only the smaller portion of them exhibited pale orbicular spots. On no other part of leaves or petioles could I find any evidence of fungus disease. I devoted three or four hours to close microscopic examination of the pale spots, because I was convinced that the subject was one of great importance, yet the dead tissue of the spots showed no mycelium which I could detect. Certainly on none of them was there any evidence of hyphæ, or external threads. The second parcel of leaves was also ample, and on a few of the oldest spots I found a little mycelium. I retained but half a dozen leaves when the parcel was shown at the Scientific Committee. Some two or three of the spotted leaves I kept nearly a week upon damp flannel under a bell-glass. At the end I found upon the spots an ample crop of the threads and conidia in all stages of an ordinary *Cladosporium*, such as *Cladosporium epiphyllum*. Although I searched diligently I could find no conidia of *Cercospora Violæ*, which has just such spots. Nearly all the species of *Cladosporium* are saprophytes, and in this instance I am under the impression that the *Cladosporium* had nothing to do with the original spotting, and that the presence of hyphæ and conidia was not manifest until after the discoloured spots, being quite dead tissue, were subjected to a damp atmosphere.

The report of the American spot disease, which is referred to *Alternaria Violæ*, states distinctly that the spots were present in most instances, with no trace of mycelium or hyphæ, and did not exhibit either until the leaves had been kept in a damp atmosphere for many hours. This seems to be precisely what happens with this British violet disease. The spots are just like those of the American disease, and are just as barren of mycelium, hyphæ, or spores. The *Alternaria* spores were only found after the leaves had been placed under new conditions. Nevertheless subsequent cultures seem to indicate that sowing healthy leaves with the spores of *Alternaria* produced the pale spots.

It is strange that the species of *Macrosporium* are not as a rule parasitic, and yet we have one British species destructive to Carnations, and in Italy another species (*Macrosporium Violæ*) is destructive to Violets.

The genus *Alternaria* is very closely related to *Macrosporium*; the conidia are almost identical, and could not be distinguished the one from the other, save that in *Alternaria* they are developed in short chains, end to end. I believe in some species of *Macrosporium* the conidia have passed into a concatenate stage and been indistinguishable from *Alternaria*. Is *Macrosporium Violæ* really distinct from *Alternaria Violæ*?

There is strong presumption in favour of the British being the same as the American disease, but this cannot be verified until, by some means or other, the conidia of the *Alternaria* can be found on the British Violets.

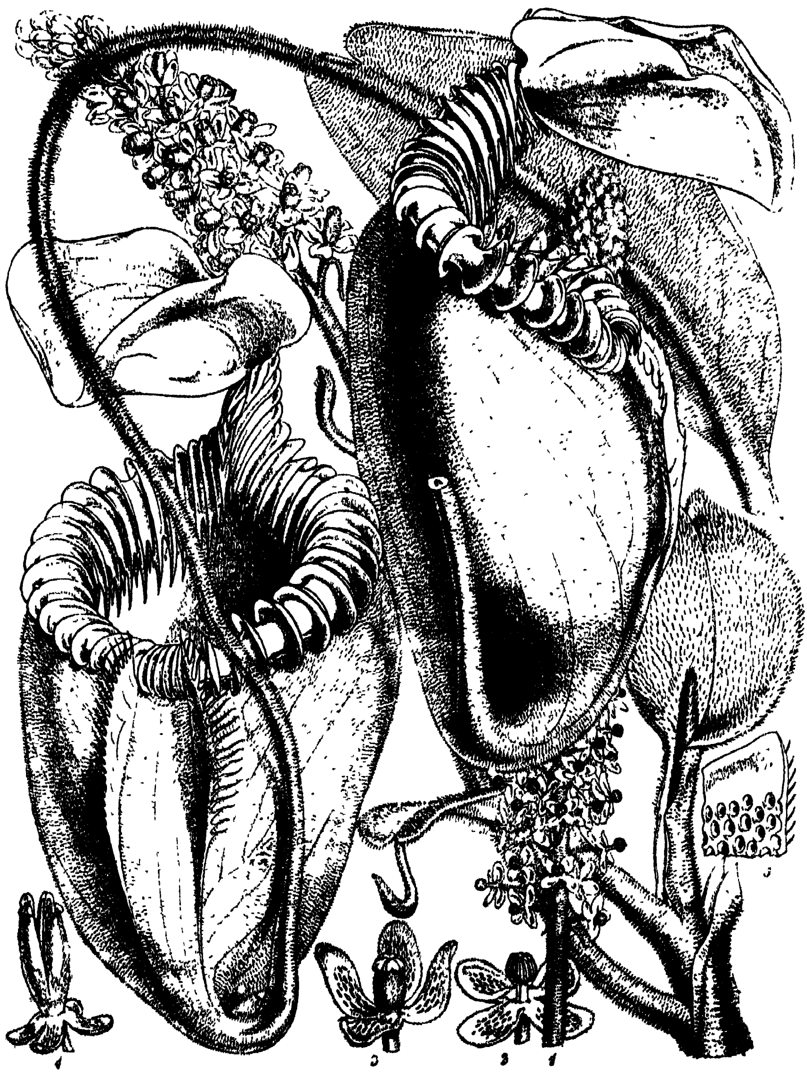
It may be suggested, finally, as worthy of remembrance in connection with these black moulds, that in some of the recorded investigations on the life-history of *Pleospora herbarum* it has been affirmed that *Cladosporium* passes into *Macrosporium*, and *Macrosporium* into *Alternaria*; so that the conidia of *Cladosporium*, *Macrosporium*, and *Alternaria* are all to be found together in the conidial stage of *Pleospora herbarum*.

VIOLET DISEASE.

By Dr. W. G. Smith, Yorkshire College, Leeds.

In September a parcel of Violets was received from the Hon. Secretary of the Scientific Committee. As complaints have been common lately, it was decided to grow the plants and observe them. On arrival there were many dead leaves, but the roots were carefully packed and the plants looked as if they would revive. They were planted in poorish soil from a permanent pasture recently dug up in making the plots for the experimental garden at the college farm at Garforth. At first the pots were soaked with water, covered with bell-jars, and kept in the laboratory. Under these conditions many leaves died, but most of the plants rooted and promised well. The dead leaves were then removed and the decaying débris cleaned from the plants, the soil was allowed to become nearly dry, and the bell-jars were removed for a few days occasionally. These conditions produced a number of fresh healthy leaves, but the disease never disappeared altogether, and could be obtained at any time by covering a plant with a bell-jar for a few days. The course of the disease is as follows: one or more yellowish-green patches appear on the leaf-blade, generally near the margin; these enlarge rapidly and the blade becomes limp and withered, the leaf-stalk still remaining upright; later the stalk collapses. In some cases the leaf-stalk was first attacked: it soon collapsed and the leaf fell to the ground. Various moulds were observed on dead leaves; we identified *Botrytis* and *Mucor* species. From time to time we examined the spots on green leaves, and our observations agree with Dr. Cooke's in his report. I could generally find a mycelium, even in early stages of attack, but the *Alternaria* spores did not appear till later. On a leaf almost completely killed I found spores which I took to be *Cercospora*. There is a disease caused by a species of this genus on Violets. A *Phyllosticta* has recently been reported on diseased Violets (*Gard. Chron.* Nov. 1901), but I never observed any fungus suggestive of this.

In regard to treatment, I can add nothing to the American report abstracted by Dr. Cooke. The disease is favoured by damp conditions, we could produce it by watering heavily and covering plants with a bell-jar; these conditions exist in forcing Violets under glass. Drier conditions and ventilation produce more healthy leaves, yet the disease was never quite absent from our pots. It has been suggested recently in the *Gardeners' Chronicle* that overfeeding is a cause of Violet disease; we believe this is so, yet we had it going on in a poor soil, with no manures added. We could not test the effects of spraying, because only a few plants were available, and a longer time would be required to see the effects.



NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

JUDGING by the number of appreciative letters received, the endeavour, commenced in the last number, to enlarge the usefulness of the Society's Journal, by giving an abstract of current Horticultural and Botanical periodical literature, has met with success. That it has entailed vastly more labour than was anticipated goes without saying, and should make the Fellows' thanks to all who have helped in the work all the more hearty.

That anything approaching perfection either in method or execution should have been achieved in the first instance, was not for one moment expected, but the Editor desires to express his most grateful thanks to all who co-operate in this work for the very large measure of success already attained by this new departure, and hopes that they will in the future as strictly adhere to the general order and scheme of working as they have in the first two attempts, as the observance of an identical *order* can alone enable the Editor to continue to cope with the work. The order agreed on was as follows :—

1. To place first, the name of the plant, disease, pest, &c., being noticed; and in this, the prominent governing or index word should always have precedence.

2. To place next, the name, when given, of the author of the original article.

3. Then, the abbreviated form of the name of the journal, &c., in which the original article appears, taking care to use the abbreviation which will be found on page 497.

4. After this, a reference to the number, date, and page of the journal in question.

5. If an illustration be given, to note the fact next, as "fig.," "tab.," or "plate."

6. After these preliminary necessities for making reference to the original possible for the reader, the abstract or digest should follow, ending up with the initials of the contributor affixed at the close of each Abstract or Note.

NAMES OF THOSE WHO HAVE KINDLY CONSENTED TO HELP IN THIS WORK.

Bennett, A. W., F.L.S., F.R.H.S.
Boulger, Professor G. S., F.L.S., F.R.H.S.
Bowles, E. A., F.R.H.S.
Chapman, H., F.R.H.S.
Chittenden, F. J., F.R.H.S.
Cooke, M. C., M.A., LL.D., A.L.S., F.R.H.S.
Dod, Rev. C. Wolley, M.A., F.R.H.S.
Druery, C. T., V.M.H., F.L.S., F.R.H.S.
Farmer, Professor J. B., M.A., F.R.H.S.
Goldring, W., F.R.H.S.
Groom, Professor Percy, M.A., D.Sc., F.L.S., F.R.H.S.
Hartog, Professor Marcus, D.Sc., M.A., F.L.S., F.R.H.S.
Hawes, E. F., F.R.H.S.
Hay-Currie, C., F.R.H.S.
Henslow, Rev. Professor Geo., M.A., F.L.S., F.R.H.S., V.M.H.
Hooper, Cecil, M.R.A.C., F.R.H.S.
Houston, D., F.L.S., F.R.H.S.
Hurst, Captain C. C., F.L.S., F.R.H.S.
Kent, A. H., A.L.S., F.R.H.S.
Lynch, R. Irwin, A.L.S., F.R.H.S.
Massee, Geo., F.L.S., F.R.H.S.
Mawley, Ed., F.M.S., F.R.H.S.
Newstead, R., F.E.S., F.R.H.S.
Paul, Geo., V.M.H., J.P., F.R.H.S.
Percival, Professor John, M.A., F.L.S., F.R.H.S.
Rendle, A. B., M.A., D.Sc., F.L.S., F.R.H.S.
Reuthe, G., F.R.H.S.
Saunders, Geo. S., F.L.S., F.E.S., F.R.H.S.
Scott-Elliot, G. F., M.A., B.Sc., F.L.S., F.R.H.S., F.R.G.S.
Shea, Charles E., F.R.H.S.
Smith, William G., B.Sc., Ph.D., F.R.H.S.
Sutton, A. W., V.M.H., F.L.S., F.R.H.S.
Veitch, Harry J., F.L.S., F.Z.S., F.R.H.S.
Ward, Professor Marshall, Sc.D., F.R.S., F.R.H.S.
Wilks, Rev. W., M.A., F.R.H.S.
Worsdell, W. C., F.R.H.S.

JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt fur Bacteriologie	Cent. f. Bact.
Comptes Rendus	Comp. Rend.
Department of Agriculture, Victoria	Dep. Agr. Vict.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Die Gartenwelt	Die Gart.
Engler Botanische Jahrbucher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Hamburger Garten- und Blumenzeitung	Hamb. Gart. Blum.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal Imperial Department Agriculture, West Indies	Jour. Imp. Dep. Agr. W.I.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. of Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R.A.S.
Journal S.E. Agricultural College, Wye	Jour. S.E. Agr. Coll.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundheitsamte	Kais. Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Notizblatt des Konigl. Bot. Gart. und Museums zu Berlin	Not. König. Bot. Berlin
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Queensland Agricultural Journal	Qu. Agr. Journ.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gén. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.*
U.S.A. Experimental Station Reports	U.S.A. Exp. Stn.†
U.S.A. Horticultural Societies' publications	U.S.A. Hort. Soc.†
U.S.A. State Boards of Agriculture and Horticulture	U.S.A. St. Bd.†
Wiener Illustrirte Garten-Zeitung	Wien. Ill. Gart.-Zeit.
Zeitschrift für Pflanzenkrankheiten	Zeit. f. Pflanz.

* The divisions in which the U.S.A. Government publish Bulletins will be added when necessary.
† The name of the Station or State will in each case be added in full or in its abbreviated form.

NOTES ON RECENT RESEARCH.

(*See also page* 186.)

THE APPLE APHIS.

Apple Aphis, The. *Aphis Mali*, Koch (*U.S.A. St. Bd. Oregon*, pp. 316–332).—Dr. John B. Smith has an instructive article upon the common Apple Aphis.

After some remarks upon the method of study he deals with the life-cycle. He found on March 28 Apple buds covered with aphis; and usually the appearance is coincident with the opening of the leaf-buds. After two or three days from the time of hatching the larva moults, becoming larger in the body, while the honey-tube is considerably longer. The second moult is reached three or four days after the first; the larvæ are then about double the original size; they have eyes consisting of several small lenses, whereas in the first stage there were only a few large ocelli, while young embryos are beginning to be visible through the cell-wall. The writer notes that the insects are continually sucking up cell-sap in far greater quantities than they require, the surplus being excreted either through the honey-tubes at the end of the body or through the anal opening, forming the well-known honeydew which gives a glazed appearance to the leaves.

The fourth stage is reached a few days after the second moult. Here the embryos have grown considerably within the body of the parent, and many minor changes are evident, particularly in the antennæ and honey-tubes.

The fifth stage, which is reached about fifteen days after birth, is the stage at which reproduction begins. The "stem-mothers," as they are called, are ·08 in. long, bright green, and almost pear-shaped. At this stage there is no separation of sexes; there are neither males nor females, but every individual is capable of producing young. The young are born alive and ready to feed at once. The "stem-mothers" have five-jointed antennæ, while the tips of certain of the leg-joints (the tibia and tarsi) are blackish, the latter character never appearing in the larval forms.

Soon after the birth of the first of this second series the aphides began to wander mostly on to the leaves. The stem-mothers produce about eight or ten young ones per day. The young of these stem-mothers differ considerably from those hatched from the eggs, the legs being longer and the beak as long as the body. The first moult is reached very quickly, the insects being then more oval and having five-jointed antennæ.

In the third stage, which is reached about three days after the second, a difference in the young is to be seen. After this second moult some of the young are pear-shaped, while others are oblong, the latter having heads and thorax larger, and distinct shoulders indicating wing pads, while the former tend to become like the stem-mothers, and have embryos beginning to develop.

A day or two after, the fourth stage is reached; in this there are forms with evident wing-pads, distinct heads, pigmented eyes, and well-marked body-segments; the other form is now very like the fourth stage of the first series, except that the antennæ are six-jointed.

The fifth stage is reached two days later, *i.e.* nine days from birth, there being now a new series of forms which bring forth young alive and a series of winged forms. The latter, which require a day to mature, after the fourth moult migrate to adjacent Apple-trees. The winged aphides are $\frac{7}{100}$ths inch long, and about $\frac{1}{4}$ in. in wing span, green, and having a black head, black raised portions of thorax, and black tips to tarsi, tibia and knee.

About three-fourths of the progeny of the stem-mother become winged, and it seems probable that the stem-mother does not live more than five days and that the progeny of one individual is under fifty. The winged forms produce young alive and without sexual union, just as in the case of the stem-mothers, the young resembling closely the larvæ hatched from the egg, and their subsequent history being similar. No winged forms were observed as descendants of the winged form.

The wingless forms produce young in a similar manner, about half of which became winged and flew to other trees. In all, seven series or generations differing in details are produced, which bring forth young alive, but no winged forms are produced after the third series. About the end of September a new series of forms appear, which become male and female, both wingless. The male is about two-thirds as large as the female, the latter being rather more pointed posteriorly than the former. Eggs are laid from about October 10 to November 20: they are black and shining, and are laid around the bud or in crevices of the trunk and branches.

The author notes several natural enemies, viz. larvæ of two species of "lady-bird," three of flower-flies, one lace-wing fly, a very small two-winged fly, parasitic wasps, and a fungoid disease.

As the insects feed by piercing the leaf, no arsenical poison is of any use. The most effective period for the application of a contact poison, such as a 5 per cent. mechanical mixture of kerosene and water or a solution of soft soap to which tobacco decoction has been added, is just after the eggs are hatched. This will give fifteen days before any reproduction takes place, and twenty-five days before any winged forms appear. The application must be thorough, as the mixture kills only what it hits, and after the foliage appears the downy hairiness of the leaves protects the insects from injury to a large extent.

The paper is enriched by two plates and thirty figures.—*F. J. C.*

APPLES.

Apples. Changes in Chemical Composition during Storage. By Dr. R. Otto (*Gartenflora*, p. 318; 15/6/1901).—The composition of eight varieties was investigated when the Apples were "ripe" in the pomological sense, and again after they had been stored in a fruit-cellar under ordinary conditions for periods between nine and thirteen weeks during the months of October 1900 to January 1901.

Six of the varieties when ripe contained no starch; the other two contained small quantities of this substance. Special attention was given to changes in those constituents of the Apple which are of importance in the manufacture of cider.

The following results were obtained:—

1. In six out of the eight varieties the specific gravity of the expressed juice, and the amount of acid, sugar, and total solid matter in it, decreased during storage of the fruit.

2. In the remaining two sorts there was a decrease in the acid and starch-content, but a small increase was detected in the sugar-content, specific gravity, and in the amount of solids present in the extracted juice.

The author mentions and agrees with the conclusions arrived at by Kulisch in 1892 (*Landw. Jahrbücher* 1892). The latter found that in many Apples, especially those ripening late, a larger or smaller quantity of starch is present when the Apples are ready to pick. This starch is changed ultimately into sugar, the rapidity of the change depending on the variety and the method of storage. Thus the total amount of sugar may increase after the Apples are picked, and the percentage sugar-content may increase also in consequence of the concentration of sap arising from the loss of water by transpiration during the period of storage.

Kulisch, however, found that from the time when all the starch in the Apple had been completely changed into sugar, the total sugar decreased in consequence of the respiration process.

The amount of acid present in the Apples also decreased both absolutely and relatively until at the end of the experiments the stored Apples only contained about $\frac{1}{3}$ of the amount present in the fresh fruit picked ripe from the tree.

The increased percentage of sugar-content of a stored Apple, due to the gradual concentration of its sap through loss of water by transpiration and the decrease of acids in the fruit, accounts for the sweeter taste which is noticeable in Apples which have been kept a time. *J. P.*

ASPALATHUS.

Aspalathus and a few Allied Genera, Histology of the Leaf and Stem of. By Ludwig Levy (Marienwerder) (*Beih. Bot. Cent.* bd. x. ht. 6).—Very little appears to have been known with regard to this particular group of *Leguminosæ*, whose characteristics are summed up by the author as follows:—They show the usual anatomical character of *Papilionaceæ*, namely, three-celled hairs, with the terminal cell longest, no typical glands, and simple clots in the wood-fibres. Their chief peculiarities are the almost centric leaf-structure, the absence of typical spongy parenchyma, the stomata being surrounded by ordinary epidermis-cells, the absence of organs for internal secretion, the extrusion of small, prismatic, needle-shaped or octahedric crystals of calcium oxalate, no external glands (except in the case of *Melolobium*), and isolated groups of bast fibres in the pericycle of the branches. Blue corpuscles, resembling indigo in appearance, were found in the dry leaves of *Melolobium*, and a saponin glucoside was discovered in some species of *Aspalathus*. The

author examined and describes the special peculiarities of eighty species of *Aspalathus*, two species of *Buchenroedera*, seven species of *Melolobium*, two species of *Dichilus*, and the single species of *Heylandia*. A key is given of the important histological characters in the leaf and stem, and a short description of the important anatomical characters of all the species considered. The paper occupies fifty-four pages, and is not illustrated.

G. F. S.-E.

Asparagus Rust.

Asparagus Rust in Massachusetts. By G. E. Stone and R. E. Smith (*Bull.* 61, *Mass. Agri. Coll.*; April 1899).

The Asparagus rust is caused by a parasitic fungus, which was named *Puccinia Asparagi* by the elder De Candolle nearly a century ago.

The Asparagus rust has occurred in Europe for some centuries, but the exact time that it was introduced into this country is unknown.

The rust was first called attention to as occurring in the Eastern United States by Professor Halsted, of New Jersey, in the autumn of 1896, although there is a possibility of its having existed on Cape Cod one or two years previous to that time.

The severe outbreak of the Asparagus rust is due to conditions of the plants, brought about largely by the excessive drought during the seasons of 1895 and 1896, and in all probability the severity of the attack was aggravated to some extent by the excessive rains of 1897.

The rust as an injurious factor has been limited to only a few places in Massachusetts, although especially affecting the Asparagus regions.

The injurious effects of the rust have been confined to dry sandy soils possessing little capacity for holding water. Where the soil is heavier, possessing more water-retaining qualities, the rust has caused no perceptible harm.

The injurious effect of the rust is apparent only when the summer stage occurs, viz. the red spores or uredospores, which develop during July and August.

The autumnal stage of the rust, known as the black or teleutospores, has been prevalent all over Massachusetts since 1896, but this form has caused no appreciable harm and is disappearing.

The loss experienced from rust in Massachusetts this season, caused by the severe uredospore infection of 1897, was from 15 to 80 per cent. in the yield of the marketable crop. The average loss will equal 20 to 25 per cent.

The practice of burning the affected tops in the summer has resulted in injury, and no benefit has manifested itself from burning in autumn.

The results obtained by spraying are not encouraging.

The various asparagus-beds on moist soils do not appear to be affected with the summer stage of the rust, and consequently are not injured, being able, as it were, to resist the summer stage, although the tops of the plants are affected with the autumnal stage during their period of natural death.

The best means of controlling the rust is by thorough cultivation in order to secure vigorous plants, and in seasons of extreme dryness plants

growing on very dry soil with little water-retaining properties should, if possible, receive irrigation.

"From observations made we are of opinion that the outbreak of the Asparagus rust is of a sporadic nature, not likely to cause much harm in the future provided attention is given to the production of vigorous plants."

M. C. C.

Parasitic Bacteria.

Bacteria parasitic on Plants. By E. F. Smith (*U.S.A. Dep. Agr. Division of Vegetable Pathology, Bull.* No. 28; 1901).—Very few diseases of plants have as yet been convincingly proved to be caused by bacteria, and the author of this bulletin is one of the few workers who aim at ascertaining definitely whether bacteria cause disease, or if they only come to hasten the decay of plants already diseased. The size (153 pp.) and the very detailed nature of the paper justify a better title than a bulletin; it is the result of a laborious bacteriological investigation on four species of yellow one-flagellate bacteria belonging to the group *Pseudomonas*. The species selected for research are:—(1) *Pseudomonas campestris* (Pammel) occurring on Cabbage, Cauliflower, Turnip, and other Cruciferæ; (2) *Ps. phaseoli* Smith, on Lima and Bush Beans; (3) *Ps. hyacinthi* Wakker, on Hyacinths; (4) *Ps. Stewarti* Smith, on Maize and Sweet Corn. The first species is probably the cause of a disease observed for several years on Turnip and Cabbage in Britain; it, as well as the second (see Journal R.H.S., vol. xxvi., 1901, p. 222) and third, has been proved by inoculation to cause disease in healthy plants; the fourth species is probably the cause of a disease on Maize in the United States. The present paper deals with the behaviour of the four species when studied by the methods of the bacteriologist, and the greater part is occupied by description of the growth on solid and fluid media, conditions of vitality, effects of temperature and sunlight, formation of ferments, pigments and other by-products. The details and results are indispensable to workers in this field. The organisms are evidently allied, and the name "Yellow Pseudomonas group" is given. From the investigations a table of distinctions of these four species has been drawn up, as well as a brief summary of the characters they have in common. These bacteria are rod-like bodies, distinguished in some phases of life by possessing a single polar flagellum; at other times they occur in short or long filaments, or in slimy masses. They grow readily on many culture media, they require oxygen, are resistent to dry air, and are destroyed by sunlight; they live in the interior of plants, and form a yellow or brownish slime. The paper concludes with a brief review of some other yellow Pseudomonas species suspected to cause disease in plants.—*W. G. S.*

Bryophyta.

Bryophyta, Notes on the Conducting-tissue System in. By A. G. Tansley, M.A., and Edith Chick, B.Sc. (*Ann. Bot.* vol. xv., No. lvii. p. 1, 1901).—The Phanerogams and Pteridophytes (Flowering plants, Ferns and Fern allies) possess a double conducting or vascular

system of well-differentiated type, with tracheid and sieve-tube components, or, in the case of certain Pteridophytes, can clearly be shown to have lost it by degeneration. The Bryophyta have no such system. But the exigencies of increasing bulk and erect habit have led to the acquirement of a conducting system, simple in most cases, but attaining high complexity, as in the *Polytrichaceæ*. The study of this conducting system in Liverworts and Mosses forms the subject of this considerable paper.—*R. I. L.*

BULGARIA POLYMORPHA.

Bulgaria polymorpha, Biology of. By R. H. Biffen, B.A. (*Ann. Bot.* vol. xv. No. lvii. p. 119).—This paper deals with the development of the fungus under artificial culture. A chief object of the author was to observe the effect of its action on wood. As a rule it is a saprophyte, but is capable of becoming parasitic, and Ludwig even considers it a dangerous parasite on the Oak. Mr. Biffen says that the results of the action of *Bulgaria polymorpha* upon Oak-wood are to dissolve and probably decompose the lignin, and to dissolve the pectates of the middle lamella, but he adds that the action is too slight, in the cases he has examined, to warrant the supposition that the fungus is capable of causing a really serious tree disease.—*R. I. L.*

CHROMOSOMES.

Chromosomes in Larix leptolepis, Gord., **Reduction of.** By Prof. Dr. C. Ishikawa (Tokyo) (*Beih. Bot. Cent.* bd. 11, ht. 1, p 6).—Twelve chromosomes were found in the pollen-grains, and each divides into two. These, after travelling to the poles, unite, forming twelve ring-shaped chromosomes. These become gradually disintegrated; their elements again become built up into twelve chromosomes, which behave in a similar manner.—*G. F. S.-E.*

CLADOPHORA.

Cladophora. "Ueber einige Verhältnisse des Baues und Wachsthums von Cladophora." By Brand (*Beih. Bot. Cent.* bd. x. ht. 8, pp. 481–521, with ten figures).—This is a continuation of the author's researches on the cell-wall and mode of growth, chlorophores and nucleus of the above Alga. The author describes an outer layer or "decklamella" of the cell-wall which can be rendered distinct by acetic acid and other reagents; it is outside the ordinary inner and outer layers. A description is also given of the manner in which the transverse septa become divided into two layers, and of the way in which the intercellular spaces are formed at the corners. The formation of the side branches by outgrowths appearing below the septa is traced in detail, and the resulting apparent dichotomy is explained. The chlorophores are generally reticulated, though small isolated plates and large pitted plates also occur. Many nuclei are frequently present in one cell, though their number is often reduced to two or even one. The growth of the cell-wall here described is of importance, and the paper should be of interest to algologists as explaining obscure points in the algæ generally.—*G. F. S.-E.*

THE CODLIN MOTH.

Codlin Moth, *Carpocapsa pomonella, L.* (*U.S.A. St. Bd. Oregon,* 1899–1900, pp. 280–315).—Prof. M. V. Slingerland gives a very full account of the Codlin moth in this report. After some general historical notes he points out the very general distribution of the pest. It occurs, apparently, wherever the Apple is grown, except, perhaps, British Columbia. While injurious chiefly to the Apple, it is also found in the Pear, Hawthorn, Crab, Quince, Plum, Peach, Apricot, and Cherry. The paper then goes on to describe the appearance and life-history of the pest. The moth appears about the time the Apple blossoms fall, and a day or two after lays its eggs on the skin of the young Apple or on adjacent leaves. The eggs hatch in about a week. The little grub finds its way into the blossom end of the Apple, where it feeds for several days, finally eating its way to the core. After about three weeks, when nearly full grown, it makes an exit tunnel to the surface, closing the outside opening for a few days while it feeds inside. Afterwards it emerges from the Apple, makes its way down the tree-trunk, and spins a cocoon under the loose bark. If in the summer, the grub then soon transforms into a pupa, from which the adult emerges in about two weeks, and eggs are laid, from which a second brood hatches. At the latter end of the summer all the caterpillars spin cocoons in the loose bark, and pass the winter in the larval condition, transforming in the spring, and so completing their life history. In the colder parts of the United States only a part of the first brood become pupal during the summer succeeding the hatching, the rest remain in the larval condition until the next spring. (It seems that there is usually only one brood in this country, but there is a certain amount of evidence that there are more.)

"How to Fight the Codlin Moth" is the subject discussed in the next few pages. Many experiments have been tried to devise an efficient trap for the capture of the moths, but with no great degree of success. It seems, however, that the prevention of the escape of the moths which may appear in the fruit-room by means of mosquito nets placed over the windows during May, June, and July would be a means of preventing their increase, since a case is reported where 1,000 moths were captured in a single day. Attempts at reaching the insect in the egg and pupal stages have met with little success, the most vulnerable point in the life-history being the caterpillar stage. Among the many means which have been recommended for the destruction of the caterpillar is the *prompt* destruction of the "windfalls"; trapping the caterpillars by means of bands of rough cloth or straw paper under which they will go in their effort to find a crevice where to spin the cocoon. These bands must be frequently examined from June to September, as the caterpillars go down at different times.

The most effective method at present in use appears to be spraying. The spray recommended is Paris green at the rate of one pound in 160 galls. or 200 galls. of water, or it may be used with Bordeaux mixture when there is any likelihood of fungoid attack. The spraying should be performed within a week of the falling of the petals. It appears that the moths do not emerge until several days after the falling of the petals;

that the moth lays its eggs upon the skin of the fruit or upon the adjacent leaves; that after the petals fall the calyx of the flower remains open for a few days and then closes; that the grub feeds for several days in the chamber formed by the closed calyx. Now, if the Paris green is applied a few days before the calyx closes, some will be deposited in the tube, and this will be protected when the calyx closes and remain there sufficiently long for the grub to reach it and be poisoned by it. This feeding in the cavity at the top of the fruit is the only feeding the larva does outside the Apple.

Spraying is not so effective with Pears, as in this fruit the calyx-lobes do not close up as in the Apples, thus leaving the poison more exposed.

Spraying must therefore be done before the closing of the calyx-tube of the Apple in order to be effective.—*F. J. C.*

Cultivation of Coffee.

Coffee Culture, Shade in. By O. F. Cook (*U.S.A. Dept. Agr., Div. Bot., Bull.* 25, 1901).—A most useful and interesting contribution to our existing literature on this "commercial crop" subject of tropical agriculture. The author advances the belief "that leguminous shade trees, in addition to the effects produced by shade trees in general in protecting the soil from erosion, drying, and heating, and in preventing the mechanical injury of the coffee plants by wind, have the same beneficial effects on coffee as clovers and other leguminous plants have on the crops with which they are so commonly rotated, that of adding nitrogen to the soil, and thus, without expense, increasing the fertility and production of a plantation."

It appears that this system of leguminous trees, which serve both as shade plants and fertilising agents, has been followed by successful Central American planters for some considerable time, without understanding the true reason.

In regard to a vast amount of literature compiled on the subject, we have those who insist on shade as the "first essential to the life of the coffee" plant. On a glance at the genus *Coffea*, which belongs to the natural order *Rubiaceæ*, it will be noted that in their natural habitat plants are seldom found under dense forest growth, but are more numerous in partially shaded positions on the borders of African forest areas. This is urged as a justification for insisting on shade being of primary importance.

As a direct effect of shade only on cultivated areas, it would become apparent in the diminished yield and inferior quality of the crop. It may therefore be deduced that neither shade nor altitude are primary requirements for successful culture. It may safely be assumed they are important only as regards "conditions of sunlight, temperature, moisture, and soil."

Although shade trees have been stated previously as not being a primary requisite, yet they are an indirect factor in conserving the moisture of soil, limiting the growth of weeds, and forming a protection against injury by wind.

The coffee plant is particularly susceptible to drought, especially

during the earlier stages of growth, as the roots penetrate the surface layers of soil only. By a glance at the figure given, the "superficial root system" is aptly shown from nature in a vertical section, and may be readily understood. Some considerable period must therefore elapse before they can reach the level of "permanent moisture."

And thus, during the earlier stages of growth, anything which tends to shade the soil and preserve moisture is an indirect factor in the economy of the plant. For this purpose suitable "catch crops" of a leguminous nature as the Pigeon-pea, *Cajanus indicus*, may be used. They would thus answer the combined purposes of shading and conserving moisture in surface layers of soil, keeping down weeds, and adding to the nitrogen in the soil in a similar manner to our own clovers. An occasional row of suitable trees may often be used advantageously as a wind-break. For this purpose Bananas, together with various forest trees, are used in several districts of Porto Rico and Mexico.

Finally, a list of shade trees and catch crops grown in conjunction with coffee in the various regions of cultivation, giving both common and botanical names, with brief descriptive notes, is well worthy of perusal by either present or prospective planters.—*E. F. H.*

Cycas Tubercles.

Cycas, Tuber-like Rootlets of. By A. C. Life (*Bot. Gaz.* vol. xxxi. p. 265, No. 4; with 10 figs.).—The anatomical structure of the so-called tubercles which appear to be fundamentally of a root-like nature, projecting from near the apex of tree-roots and branching dichotomously. They contain a zone nearly midway in the cortex of longish cells associated with intercellular spaces. It appears that fungi, such as bacteria and mycelium, prepare the way for an alga, by causing destruction of cells and the production of empty spaces. The alga, which appears to resemble the green chain of cells in the lichen *Nostoc*, takes up its abode in the intercellular spaces, giving a greenish colour to the zone. This is interrupted at places below lenticels, so that the author comes to the conclusion that those tubercles of Cycads may be said to have at least two functions, that of aërating and that of assisting in nitrogen assimilation the alga living in symbiotic association with the Cycad.—*G. H.*

Cryptogamic Diseases.

Diseases of Plants, Cryptogamic. By J. Ray (*Rev. gén. Bot.* xiii. p. 145, 1901).—Many parasites are superficial and only affect the host plant locally. Thus *Botrytis cinerea* is said to develop on the green leaves and flowers of many plants, and to injure them indirectly by interfering with respiration and carbon assimilation. The evils can be remedied by exposing to a light sufficiently intense to permit the chlorophyll to resume its activity in spite of the covering of mould. The oxygen, it is said, may be also administered in the form of injection of oxygenated water. But the author does not suggest that these cures possess more than a theoretical interest.

When dealing with internal parasites, *e.g. Botrytis*, as it often

flourishes, the mode of cure attempted was by inoculation with an antitoxin, prepared from attenuated cultures of the pest. In other cases it is recommended that the extract of a plant which is naturally immune be injected in place of the antitoxin.

Analogous prophylactic measures are described in relation to *Bacillus putrefaciens*.—*J. B. F.*

ECOLOGY.

Ecology, The Physiographic, of Chicago and vicinity ; a study of the Origin, Development, and Classification of Plant Societies. By H. C. Cowles (*Bot. Gaz.* vol. xxxi. p. 73, No. 2 ; p. 145, No. 3).—The author observes that Ecology, or the study of plants in relation to their environment, is now regarded as important, and the present paper is to suggest a classification of a portion of the ecological field.

Ecology includes the study of the origin and life-history of plant structures, as also of plant societies.

(1) Climatic factors issue in tropical forests, deserts, prairies, &c. These suggest an ecological plant geography. (2) Local influences, as soil, slope, light, &c., or the physiographic nature of a district.

The climate may be the *same*, but these factors produce marked changes of themselves. Hence are swamp, dune, forest, river-bluff, &c.

"Physiographic Ecology."—Plant societies are grouped as hydrophytes, mesophytes, and xerophytes.

The author observed that while heaths and moors have closely similar species and vegetative adaptations, their plant societies were often found grading into each other.

In *water-content* these societies were *very different*, the peat-moor or bog being hydrophytic, and heath xerophytic. Hence some factor other than water-content is responsible for both.

Vegetation of peat-bogs is radically different from that of river-swamps, which have the *same water-content*.

While *atmospheric* influences (light, heat, air) operate over wide areas and have subordinate local importance, *soil* influences (including the heat, air, and water in it), as well as chemistry and physics, are of predominant *local* importance. These depend on surface geology and topography.

To illustrate the principle of physiographic ecology, the author describes "The Inland Group" of a River series. He commences with the uppermost ravine at the source of a river, which is deep and narrow through vertical cutting away. Here, if it be clay, the steep sides are almost entirely void of vegetation, because of the instability of the soil and of landslides. Lower down the slopes are less precipitous, and the ravine widens more than it deepens, so that a sufficient stability is acquired to permit of a considerable growth of vegetation. It is here that the highest type occurs ; having passed through the herbaceous and shrubby stages to the highest "mesophytic" forest—a Maple (*Acer saccharinum*) found associated with Limes (*Tilia americana*), Ashes, Elms, &c. ; the most characteristic undershrub being the Witch-hazel (*Hamamelis virginiana*). The herbaceous plants are vernal forms, *e.g. Hepatica*,

Thalictrum, *Trillium*, *Mitella*, *Dicentra*, and *Sanguinaria*, with many mosses and liverworts.

Such ravine conditions are more favourable for plants than any others.

Rock ravines exclude landslides, hence the sides are often vertical. Denudation is slow, and therefore more stable conditions exist. Being shady and often dripping, rockbound gorges abound with cryptogams, as ferns, mosses, &c. Shade-loving flowering plants occur, as *Impatiens* and *Pilea*. As the cañon broadens out and the slopes become less steep, shrubs and trees appear, though a typical mesophytic forest is rarely seen. Whether it be sandstone or limestone, the vegetation is essentially alike: showing that is the physiographic stage of a region which is of the greatest importance; so that rock, as such, or even the soil which comes from it, is of less importance than the aerial conditions and exposure in determining vegetation. As the valley deepens and widens, there appear two phases, the river-bluff and the bottom. The exposure to wind, sunlight, and changes of temperature increase; moisture decreases. The liverworts and moisture-loving mosses disappear, while a "xerophytic" undergrowth now flourishes. *Antennaria*, *Poa compressa*, *Equisetum hyemale*, and *Polytrichum* are common types. Commencing at the top they spread downwards, often almost to the water's edge. The shrubs consist of such as *Ptelea trifoliata*, *Celastrus scandens*, *Rhus typhina* and *R. glabra*, *Prunus virginiana*, *Physocarpus opulifolius*, *Pyrus coronaria*, *Amelanchier canadensis*, and *Ostrya virginica*. The last of the mesophytes to die are trees such as Tilias and Acers; but they cannot be succeeded by their own kind, inasmuch as the critical seedling stages cannot be passed successfully.

In the rock-ravines, when passing into xerophytic stations, conifers such as *Pinus Strobus* and *Thuya occidentalis* find their home. The herbs and undershrubs of a xerophilous nature consist of such plants as *Selaginella rupestris*, *Campanula rotundifolia*, *Pellaea atropurpurea*, *Talinum teretifolium*, *Opuntia Rafinesquii*, &c.

The next physical feature is the formation of a flood-plain. When river-slopes become more and more gentle, mesophytes spread upwards over them. A true aquatic flora is now characteristic of the meandering stream, which could find no foothold in the earlier and more rapid stages of the river, which, moreover, may be only present after storms. A brookside flora now appears as *Symplocarpus fœtidus*, *Asclepias incarnata*, *Chelone glabra*, *Polygonum sagittatum*, species of *Eupatorium*, *Lobelia*, *Mentha*, *Lycopus*, *Bidens*, and *Alnus incana*.

When streams are old enough, and therefore slow enough to support a pond vegetation, they have become essentially depositing rather than eroding streams. The order of appearance is the giant Ragweed (*Ambrosia trifida*), Willows, River Maple (*Acer dasycarpum*), the Cottonwood (*Populus monilifera*), and the Ash (*Fraxinus americana*).

Gradually the growing flood-plain becomes dry enough to permit the germination and development of a true mesophytic flora. The preceding trees are then replaced by Elms (*Ulmus americana* and *fulva*), the Bastwood (*Tilia americana*), Walnut (*Juglans nigra*) and Butter-nut (*J. cinerea*), and the Pig-nut (*Carya porcina*).

There are many lianes climbing over the trees, *e.g.* the Greenbriar

(*Smilax hispida*), Grapes (*Vitis* sp.), Virginia Creeper (*Ampelopsis quinquefolia*) and Poison Ivy (*Rhus Toxicodendron*).

Among the shrubs of the undergrowth, which is abundant from the moist soil, are various species of *Cratægus*, *Ribes Cynosbati*, &c. The herbaceous vegetation is mainly vernal, as the shade is deep. Prominent among it are *Trillium recurvatum*, *Phlox divaricata*, *Polemonium reptans*, *Mertensia virginica*, *Claytonia virginica*, *Erythronium album*, *Arisæma triphyllum* and *A. Dracontium*, *Nepeta Glechoma*, *Viola cucullata*, *Galium Aperine*, *Urtica gracilis*, &c.; various umbellifers of the genera *Heracleum*, *Sanicula*, &c., and the Dodder (*Cuscuta Gronovii*).

Flood-plains sometimes consist of meadows instead of forests. Besides various grasses, such as *Poa pratensis* and *Agrostis alba*, *vulgaris*, *Thalictrum purpurascens*, *Fragaria virginiana*, and *Anemone pennsylvanica* occur abundantly. Extensive thorn thickets (*Cratægus* sp.) sometimes occur, probably betokening the beginning of a mesophytic forest.

Though the last feature is the climax, retrogressions may take place in connection with terrace formation. While deposition is the main feature of flood-plains, erosion still continues, which causes vertical banks in the flood-plain. It may thus swing quite across its flood-plain, destroying all that it has built, including the mesophytic forest, not only by undermining and so felling the trees, but by draining the plain it becomes more xerophytic.

In making serpentine curves, "oxbow" lakes are formed by the river breaking across the peninsula. River-life is then soon replaced by pond-life.

The author next considers the Pond-swamp prairie series. These are all gradations between rapid streams and completely undrained ponds, and corresponding with these various gradations are characteristic plant species.

No two floras can be more unlike in species or in adaptations than are the typical brookside and swamp floras. Both hydrophilous, yet peat-bogs have many xerophytic adaptations, such as leathery or hairy leaves, and special structures for water-absorption. Schimper believes that these structures are due to the difficult absorption in peaty soil, the humus acids and the lack of oxygen being detrimental to normal root activities, and the activities of soil-bacteria are lessened. Hence, peat accumulates in consequence of the lack of drainage.

The principal cause of the destruction of undrained lakes is vegetation. According to the depth of the depression is an undrained swamp or pond. In this latter Charas abound, as well as Water-lilies and Utricularias. The rapidity with which the filling-up process of these plants is carried on is striking, for the accumulation of Chara-peat amounts to 1 or 2 inches per annum.

As the pond or lake becomes shallower, it becomes less fit for pond-life, and the marginal flora invades it, such as *Scirpus lacustris*, *Menyanthes trifoliata*, and *Potentilla palustris*.

The next vegetation which follows consists of typical peat-bog plants, as the leathery-leaved *Cassandra calyculata*. Then a tree zone of *Larix americana* and *Thuya occidentalis*, then *Pinus Strobus*, &c., advances upon the last-named.

Other shrubs associated with *Cassandra* are species of *Vaccinium*, *Betula pumila*, *Alnus incana*, *Salix candida*, *Rhus venenata*, *Sarracenia purpurea*, *Drosera rotundifolia*, various Orchids, as species of *Calopogon*, *Pogonia*, and *Cypripedium*, with sedges, as *Eriophorum* and *Sphagnum*.

Not only the adaptations, but the species themselves, are similar over vast areas; the conditions are unique, and the flora also.

As flood-plains may develop either forests or not, so where peat-bogs existed there may grow up shrubs and trees, or herbs and grasses may be dominant. In this case Bulrushes encroach on Water-lilies, followed by sedges, grasses, and willows. Other plants consist of *Viola*, *Potentilla anserina*, *Fragaria virginiana*, *Parnassia caroliniana*, *Gentiana crinita*, *Iris versicolor*, *Sisyrinchium angustifolium*, *Triglochin maritima*, &c.

Prairies are formed by sedges encroaching upon bulrushes, and grasses upon sedges, as the soil becomes raised more and more. Coarse xerophytic herbs may accompany the grasses, as *Silphium*, *Solidago rigida*, species of *Melilotus*, *Baptisia*, *Eryngium*, *Dodecatheon*, *Phlox*, &c. This explanation of prairies around Chicago must not be applied to the great climatic prairies further west.

The next group considered are the Upland series, such as Rock hills, at first almost bare of vegetation, but by the decay of rock and accumulation of organic matter shrubs begin to appear, such as *Prunus virginiana*, *Rhus Toxicodendron*, *Rhus typhina*, *Ptelea trifoliata*, and *Pyrus coronaria*.

Xerophytic tree vegetation follows, and ultimately a mesophytic one.

The Clay hill is another instance of special type of vegetation. They are morainic in origin, and always covered with mesophytic forests of Oaks and Hickory as the predominant species. The soil is a composite glacial clay, rich in food salts.

Lastly are considered the various coastal types, such as the Lake-bluff series, at first almost entirely without vegetation Then herbs find a place, as *Equisetum hyemale*, species of *Aster*, *Melilotus alba*. Then comes a xerophytic thicket of *Juniperus communis*, *J. virginiana*, and *Salix glaucophylla*. The following tree stage includes species of Poplar, *Ostrya virginica*, *Pinus Strobus*, and Oaks.

Lastly are the Beach-dune-sandhill series. Starting from the embryonic stage of a beach-dune, such plants as can stand shifting sands are *Ammophila arundinacea*, *Salix glaucophylla* &c., *Prunus pumila*, and *Populus monilifera*.

Various sub-types of dunes and their inhabitants are described. The most ancient beach-dunes are covered with trees and undershade, consisting of *Corylus americana*, *Ceanothus americanus*, *Salix humilis*, *Vaccinium pennsylvanicum*, &c., and species of Oaks predominate.

The paper concludes with a general summary.

Similar interchanges to the preceding, in the country about Chicago, are described by Alb. Nilsson as occurring in Sweden (*Bot. Not.* 1899, pp. 89–101, 123–135). Mr. H. C. Cowles abridges his work as follows:—"Speaking of cliffs and moors, he finds three types of cliffs, those which are forested either with conifers or deciduous trees, and those without trees. On all cliffs the first plants are crustaceous lichens. On the conifer cliffs there follow in succession, fruticose lichens, herbs, heath-plants, conifers.

"Cliffs with deciduous trees have no fruticose lichens nor heath-stages, the author attributing the absence of the fruticose lichens to wind.

"On the third type of cliff the lichens remain longer, and foliose lichens and mosses are added to the stages after crustaceous lichens.

"Dying lakes pass into sedge-moors, then into cotton-grass-moors, finally into shrub-moors and forest-moors with pines or birches.

"Retrogressive phases are common on the moors, lichens growing over the peat-moss and shrubs; again the water collects and the lichens pass away. The peat-moss appears again, and we have what Nilsson calls a secondary moor."—*G. H.*

Experiment Stations in Hungary.

Experiment Stations in Hungary. By E. W. Allen, Ph.D. (*U.S. I. Exp. Stn. Record*, vol. xiii. No. 1, 1901).—Hungary possesses twenty-one Governmental experimental stations or divisions, with a director in charge of each station. From this number of stations tests are provided in respect of agricultural chemistry, seed control, entomology, plant and tobacco culture, vegetable physiology and pathology, animal physiology and feeding, and agricultural machinery. The stations are instituted for the promotion of agricultural science and practice amongst the farming classes. Original research and practical experiments are conducted, from the results of which advice of a valuable nature can be given. Since 1898 a Central Commission, consisting of a president, secretary, and about twelve permanent members, who are appointed by the Minister of Agriculture, direct and supervise the individual stations. A journal containing reports of the work is published by the Commission. Of the eight chemical stations, three work entirely on the examination of agricultural and other products. The remaining five, in addition to the above work, carry on scientific agricultural investigations. The commencement of seed testing was in 1871, and has been gradually extended from a single station until at the present time there are six in full working. From a minimum number of sixty-two samples tested in 1881 the total had grown to 32,487 in 1898. All seed-control stations are attached to Agricultural Institutions, with the exception of the "central" one at Budapest, which possesses the largest working staff. The directorship of other stations is vested in the Professor of Botany at the Institute with which each station is connected. Two stations examine and test various inventions of implements and machines, and supply complete information in regard to same. One station carries out plant and "pot culture" experiments, and another deals with the promotion of the tobacco industry, the latter having a sub-station attached. The value of these stations to those engaged in tobacco culture may be gathered from a brief summary of their work. The above central station occupies about 29 acres of ground. Of this, various buildings, including laboratory, rooms for gardeners, curing barns of various types, sorting and storing houses, &c., cover about 7 acres; a botanical garden, containing 209 different varieties of tobacco, garden and field for culture experiments, and hotbeds covering nearly $1\frac{1}{2}$ acres. Entomology is represented at a station from

which information and advice concerning insects injurious to special crops may be obtained. The director is also empowered to take immediate steps to check any serious insect attacks which may occur from time to time. The chief object of another is to study "nutrition, growth, and propagation of all cultivated plants, the breeding of high-grade sugar beets, the effects of unfavourable conditions of life on plants," and injuries due to "parasitic fungi," with prevention and remedies. Finally, experiments in physiology and feeding of "horses, swine, sheep, and poultry" at a similar station show that considerable service to the Hungarian industries is thoroughly rendered by this important Government system.—*E. F. H.*

SHADE-TREE- AND TIMBER-DESTROYING FUNGI.

Fungi, Shade-Tree- and Timber-Destroying. By Geo. F. Atkinson (*Bull.* 193, *Cornell Univ. Ag. Exp. St. Bot. Div. Ithaca, N.Y.* 1901).—This is a careful and well-illustrated study of the diseased condition set up in trees by the presence of the mycelium of the larger fungi, such as *Polyporus*, the time and mode of entrance of the fungus, as well as the nature of the wounds that enabled the enemy to enter the living tissues of the tree. The following species are described:—

Polyporus borealis attacks Pines, Spruces, &c. It is a wound parasite.

Polyporus sulphureus occurs on Apple, Walnut, Oak, Ash, Pine, &c. Fruit bodies grow from knot-holes, wounds, &c. It is also found on decayed wood. In one tree (an Oak) examined it was discovered that the fungus must have entered thirty years ago, when the tree was quite a sapling. The growth of the mycelium is slow.

Polyporus igniarius occurs on Apple, Oak, Alder, Beech, Birch, Maple, &c. The fungus appears in most cases to gain an entrance through wounds when the tree is quite young.

Polyporus pinicola found on Pines.

Trametes Abietis on Spruces.

The author shows why it is that once any of these fungi enter the tree there is no chance of saving it from ultimate destruction. The tree may grow for years (even a hundred years), but the fungus grows with the tree's growth and affects the wood, the foliage, or the fruit.

The importance of inspecting nursery stock to see that the stems and branches are free from wounds is clearly demonstrated. Wounds caused by pruning might with advantage be washed over with some antiseptic wash or painted with lead paint. The booklet is illustrated by ninety-four photographs.—*D. H.*

GYMNOCLADUS DIOICA.

Gymnocladus dioica. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 7, p. 210; July 1901).—Almost always diœcious; the male forms are abundant in the plantations of France, but fructification is rare. Of the trees at Toulouse, the largest are male, and only one, a younger plant, is female, which has produced six large flattened, coriaceous and woody pods, which are somewhat curved, of a reddish-brown colour, and each containing four to five large, lenticular seeds. *Gymnocladus* belongs to

the tribe *Cæsalpinieæ* of the order *Leguminosæ*. Linnæus included this plant within the genus *Guilandina*; Lamarck first separated it in 1783, giving it the name of *Gymnocladus canadensis*. At present *Guilandina* is only a subgenus of the genus *Cæsalpinia*. A native of Canada, it was introduced into European cultivation in the first half of the eighteenth century. André speaks of its being distributed throughout a large part of North America. The tree has an erect stem attaining a height of 30 metres and a circumference of more than 2 metres; the bark is blackish-grey; the leaves are 40 cm. to a metre long, bipinnate, composed of glabrous, ovate, acute, alternating leaflets, which turn bright yellow in autumn. The flowers are in short terminal racemes, with greyish-white petals, regular in shape, and slightly cottony. The generic name is due to the tree's appearance in winter; the shortened, and by no means numerous, branches giving it a very bare appearance. Its hard, fine-grained, pink-coloured timber is highly esteemed by ebony-workers. *G. sinensis* is another species from China, distinguished by its smaller and pink flowers. *Gymnocladus* likes a deep, stiffish soil. It may be propagated by suckers or by means of the roots; pieces 12 to 15 cm. long should be planted in very light soil kept constantly moist; they do not usually shoot the first year; it is the same with the seeds, which often only germinate the second year.—*W. C. W.*

Anatomy of Leaf and Axis.

Leaf and Axis, Anatomy of, in some Crotalariæ. ("Vergleichend-anatomische Untersuchungen von Blatt und Achse einiger Genisteen Gattungen aus der Subtribus der Crotalarieen Bentham-Hooker"). By Georg Cohn aus Wirsitz (*Beih. Bot. Cent.* bd. x. ht. 8, pp. 525–561).—In addition to the ordinary Papilionaceous characters, the genera studied show the following peculiarities, namely:—A distinct centric type of leaf, no spongy parenchyma with large intercellular spaces, no internal secretory organs, no external glands; small needle-shaped to prismatic crystals of calcium oxalate are sometimes produced. The stomata of *Rafnia* are surrounded by 3–6 "neighbour-cells." The nerves of *Borbonia* leaves are enclosed on both bast and wood sides by sclerenchyma plates. The cork formation varies, as also the structure of the pericycle, which may consist of isolated groups of bast-fibres or of a united and continuous mechanical ring. The plants investigated, and of which a short account is given, belonged to the following genera:—*Borbonia* 6 species, *Rafnia* 15 sp., *Euchlora* 1 sp., *Lotononis* 24 sp., *Rothia* 1 sp., *Lebeckia* 10 sp., *Viborgia* 3 sp. A tabular view is given of the anatomical conditions of the leaf in the species investigated.—*G. F. S.-E.*

The Middle Lamella.

Lamella, the Middle, its Origin and Nature. By Ch. E. Allen (*Bot. Gaz.* xxxii. pp. 1–34, No. 1).—After a discussion upon previous observers and theories to account for the origin and use of the middle layer between cells of a tissue, it appears that Dippel first discovered that it was *not* cellulose (1898). Frémy gave the name pectose to a substance

in fruits, and Mangin (1888) found that plant-cells consisted of a combination of cellulose and pectose; and that the latter constituted the middle layer in many adult tissues. He regarded it as the first membrane formed in cell division, or "the fundamental layer of the cellular membrane." This seemed to indicate that he considered it as identical with the "cell-plate" of a dividing cell.

In 1890 Mangin corrected his view, as he found the middle layer to consist, not of pectose proper, but of a cement of insoluble pectates.

The intercellular substance forms a thin layer on the whole surface of contact of adult cells; when the cells separate, so as to form intercellular spaces, these spaces are bounded by a pectic layer (detected by staining with ruthenium red).

With regard to its origin, Dippel said that cambial cell-walls are composed of pectic acid, which, at least after the transformation of these walls into the so-called "intercellular substance," exists largely in the form of calcium pectate.

As the cambial daughter-cells are transformed into bast and wood tissue, the primary cell-walls, consisting of pectose and cellulose, are deposited next to the now apparently simple cambial walls, which undergo a transformation into the "intercellular substance."

The combination of this latter with the primary cell-wall forms (in his view) the middle lamella of mature tissues, against which secondary thickenings are deposited.

The author described his investigations upon *Pinus sylvestris*, *Nerium Oleander*, *Rosa* sp., *Tilia americana*, and *Ilex opaca*. He then criticises the above view of Dippel. He finds that the middle layer is of a pectic character, but that it undergoes changes with age. He thinks that Dippel's idea that the intercellular substance is derived from the walls of the cambium mother-cells has little evidence in its favour.

The author prefers to regard this "intercellular substance" as representing pectic acid which has exuded through the cambium cell-walls into an intercellular cleft, formed by the splitting of the radial wall. Its ultimate fate is to be absorbed into the adjacent cell-walls. There is no trace of this substance *except in the Pine*.

Intercellular spaces in other plants can be accounted for only by the rounding up and drawing apart at their corners of adjoining cells. This induces a splitting of the middle lamella.

Referring to the formation of the cell-plate in meristem tissues, the author observes: "On the basis of the later investigations respecting the relation of the cell-wall to the cell-plate, we have seen that the middle layer appearing after the splitting of the cell-plate is to be considered as formed by deposition from the split halves of the original plate; the middle lamella of mature tissues would include, then, in addition to possible later deposits, both the layers deposited on the inner surfaces of the daughter plasma membranes."

The middle lamella is therefore of a double nature, capable of splitting into two in forming intercellular spaces.

Strasburger's view is confirmed that the cell-plate splits *before* the new cell-wall is laid down, the latter thus having a double nature from the start.

The growth in thickness of the middle lamella can often be traced. It consists, therefore, of the layers first deposited by the plasma membranes, *plus* a certain amount of material subsequently deposited in contact with these layers, which is generally rich in pectic compounds as compared with the still later deposited strata.

As the cells grow to maturity the middle lamella loses its power of adapting itself to the varying forms of the adjoining cells, and becomes fixed and inflexible. This is due to the pectic acid changing into insoluble pectates, chiefly the calcium salt. In cork cells of *Tilia* it becomes changed to suberin.

Such appears to be, in brief, its history from its commencement in a dividing cell to the permanent and lifeless condition, as of cork, bast, and wood.—*G. H.*

LEAVES.

Leaves, on the biological types of, belonging to the orders Fagaceæ, Monimiaceæ, Melastomaceæ, Euphorbiaceæ, Piperaceæ, and Chloranthaceæ. By Prof. Dr. Anton Hansgirg (Prague) (*Beih. Bot. Cent.* bd. x. ht. 7, pp. 458–480).—The chief types in the genus *Quercus* may be placed as follows:—

I. *Deciduous Leaves.*—Glabrous or slightly hairy, sometimes felted on underside.

II. *Leaves Evergreen.*—Dry-climate oaks with leaves more or less leathery, glabrous or thickly hairy below, entire or spinose at margins.

All the species are enumerated and placed in position. Besides these two main classes, the following are mentioned:—

1. Poplar-like wind-leaf, *Q. petiolaris* &c.
2. Rain-leaves with acuminate apex (Driptip), *Q. cuspidata* &c.
3. Arranged to allow light to pass to lower leaves (*Q. Robur* form).
4. Ericoid rolled leaves, *Q. vulcanica* &c.
5. Leaves with wax outgrowths *Q. rigida.*
6. Leaves with many small glands, *Q. resinosa* &c.
7. Glandular toothed leaves of *Q. glandulifera* &c.
8. Spinose toothed leaves armed against animals, *Q. acutifolia* &c.
9. Gnaphalium-like leaves, *Q. Helferiana* &c.
10. Leaves with a more or less developed amount of tannin. raphides, &c.

Dimorphic leaves also occur.

The genus *Fagus* and the other natural orders mentioned above are treated in a similar manner, the leaves of all the species being classified according to their functions. The classification follows that in the author's "Zur Biologie der Laubblätter," 1900.—*G. F. S.-E.*

LOCUST FUNGUS.

Locust Fungus. By G. Lindau (*Not. König. Bot. Berlin*, No. 26, b. iii. p. 109, July 5, 1901, 1 tab.)—For some time it has been known that the locusts of South Africa suffer from the attacks of a parasitic fungus, and it is but a short time ago that we heard of cultures of the infective material being successfully distributed in order to encourage

a wider spread of the epidemic among these dire enemies—themselves constituting an epidemic scourge—to the planters. Unless we are in error as to the memory of an event, English investigators had already established and published the fact that the fungus in question was not a Bacterium, an *Empusa*, *Isaria*, or such form as might naturally be expected from previous experience, but a *Mucor*, a discovery of supreme importance in view of recent developments regarding the possibilities of the assumption of parasitic habits by genera usually saprophytic.

Lindau has now come forward with a complete account of the sporangiferous stage of this fungus, with a plate of illustrations, showing clearly that it is really a typical *Mucor*—he proposes the name *Mucor locusticida* for it—and leaving little to be desired beyond details of infection and the production of zygospores.

It is greatly to be hoped that investigations on the spot will supply these details in due course.—*M. W.**

Morphology.

Morphology, Cardinal Principles of. By W. F. Ganong (*Bot. Gaz.* vol. xxxi. p. 426; No. 6).—A summary of the principles upon which the newer morphology is based. The author distinguishes between "idealistic" and "realistic" morphology; the former is concerned with the physical facts of metamorphoses in organisms, the latter lays especial emphasis on embryology. The one is phylogenetic, the other ontogenetic. Both are independent of the exact method by which the evolution is worked out.

The following are the author's fundamental principles of morphology:—Continuity of origin, opportunism, functional domination, indeterminate anatomical plasticity, metamorphosis along lines of least resistance, metamorphosis by transformation, and gradation in morphological membership. Each of these is treated in detail.—*G. H.*

Origin of Species.

Origin of Species, experimental Investigations in the. By Hugo De Vries (*Rev. gén. Bot.* xiii. p. 5, 1901; figs. 1–10).—Prof. De Vries is well known as an experimenter in connection with problems dealing with matters concerning heredity. By sowing, in large numbers, seeds of *Œnothera Lamarkiana*, Seringe, he obtained amongst the offspring a few individuals possessing characters which differentiated them from the parent stock. Some of these, *e.g.* *Œ. albida*, *nanella*, &c., reappeared in fresh annual sowings of the *Lamarkiana* seed, whilst others, *e.g.* *Œ. gigas*, seem to occur only at infrequent intervals. The author regards the parent species as being in a condition of mutability, as giving rise at the present time to new species, of which he takes the varieties he obtains as evidence. He believes that this represents the most probable mode in which such new species are normally produced, and that the gradual

* Since writing this we have seen Mr. Massee's paper "On the South African Locust Fungus," *Kew Bull.*, Nos. 172–174, 1901, in which the *Mucor* is named *M. exitiosus*: there are differences between the two forms which need further investigation.

transformations which are usually assumed to occur, as steps in the process, do not in reality contribute to a solution of the difficulties of accounting for the origin of new races. A more complete account of Prof. De Vries's observations and theories will be found in the first volume (all as yet published) of his "Die Mutations-theorie: Versuche und Beobachtungen über die Entstehung von Arten im Pflanzenreich," published at Leipzig.

J. B. F.

PELLIA.

Pellia, Nuclear Studies on. By Bradley Moore Davis (*Ann. Bot.* vol. xv. No. lvii. p. 148).—The Liverworts, the author says, are interesting because they offer the possibility of solving certain problems of great importance to our understanding of the morphology of the plant-cell, and particularly the conditions characteristic of nuclear divisions in the higher plants. His efforts have evidently been directed to a thorough knowledge of *Pellia* from this point of view.—*R. I. L.*

PEPEROMIA.

Peperomia, Embryo-sac of. By Professor Douglas Houghton Campbell, of California (*Ann. Bot.* vol. xv. No. lvii. p. 103).—The author reiterates his opinion that in *Peperomia* we have the most primitive type of Angiosperm yet described. The most remarkable fact brought out in the study of the embryo-sac, he says, was in the behaviour of the nuclei, which differ remarkably from those of other Angiosperms. The marked polarity of the typical embryo-sac is found entirely wanting, and by further division of the eight nuclei, unique so far as known, there are normally sixteen nuclei in the unfertilised embryo-sac.—*R. I. L.*

ACTION OF MINERALS.

Physiological Rôle of Mineral Substances. By M. E. Demoussy (*Ann. Ag.* p. 317, July 25, 1901).—Where lime does not exist the leaves of Beetroot are spotted with yellow; mosses do not form spores. Phosphoric acid necessary for cellular division and the production of chlorophyll. Iron, although not present in chlorophyll, is necessary for its formation. Iron necessary to the lower fungi. The pollen of Pines contains manganese. Chlorine not useful to vegetation generally, though Buckwheat, which grows well without it up to the flowering period, will not seed without chloride of potash. Chloride of soda (common salt) retards the development of Wheat, also its germination. Fluorine not necessary to plants. Green plants require potassium to utilise the hydrates of carbon and albuminoids; most of the fungi also require potassium. Sodium salts do not replace those of potash, but may have beneficial effect in neutralising acids and in osmotic functions. Wheat is sometimes benefited by them. Leaves proportionately contain more lime; the flowers, roots, bulbs more magnesia. In trees magnesia increases towards the centre. Lime increases towards the bark. Of the elements—phosphoric acid, potash, magnesia, and lime, the absence of lime makes itself felt before all others. Lime apparently assists in the transport of starch up the stem, in chemical transforma-

tions, and is necessary for the protoplasm. Salts of magnesium appear to be injurious unless there be sufficient salts of lime to counterbalance its ill effects. Both Potatos and Beetroot are said to be more susceptible to cryptogamic disease on soil that has been limed. Bacteria and *Penicillium* require a small quantity of magnesia to germinate and grow. Magnesia helps in the assimilation of phosphoric acid. Where lime is in excess the assimilation of phosphoric acid is retarded. Magnesia in the seed is favourable to the quick development of the embryo. In applying kainit, one should take account of the amount of magnesia contained. It may be advisable to lime the land in order to combat the effects of too great a quantity of magnesium salts. —*C. H. H.*

Polypompholyx and Byblis.

Polypompholyx und Byblis gigantea, Untersuchungen über Morphologie, Anatomie, und Samenentwickelung von. By Franz Xaver Lang (*Flora*, vol. lxxxviii. Pt. 2, pp. 149 206; t. xii. and thirty figures; March 2, 1901).—The former is a Utricularian genus of terrestrial habit dwelling in moist sandy places. *Polypompholyx multifida* forms the chief object of study; the material was collected by Goebel in W. Australia. It has entire, linear, long, petiolate leaves (12 × 2 mm.); *runners*, arising from the base of the terminal scape, thread-like organs (25–28 mm.) which bury themselves in the ground, and serve possibly for absorption as well as fixation; bladders of two slightly different kinds, those with longer stalks sunk in the soil, while the short-stalked ones protrude above it. The contents observed are sand and organic materials, including, besides humus, algæ of various kinds, remains of insect larvæ, and nematode worms; their structure and histology are essentially identical with those of the bladders of *Utricularia*. The base of the stem is thickened into a corm, below the slender cyme, and is rich in schizogenous air-canals. The fibrovascular elements have the same separation of phloem and xylem that exists in other Utricularias. The inflorescence is racemose; the flower has four distinct sepals, five petals, forming a bilabiate corolla with an anterior spur; two anterior stamens, and often rudiments of two postero-lateral ones. The arrangements for cross-pollination are described; the development of ovule and embryo-sac presents no very exceptional characters. After pollination, the centre of the embryo-sac becomes full of endosperm by "free cell-formation"; but the two ends grow out, each into a haustorium that branches and burrows fungus-fashion in the nutritive tissue of the nucellus. Finally, the endosperm is absorbed, all but a thin investing membrane; and the embryo is spheroidal, unsegmented, with a depressed growing point. *P. tenella*, collected at Melbourne, only differs in minor points. *Byblis gigantea*, Lindl., has hitherto been referred to *Droseraceæ*; it is a perennial undershrub with an obliquely ascending rhizome, sending up a thick erect annual stem (40 cm.), with equidistant, spirally arranged grass-like leaves, and solitary axillary flowers with long pedicels. The leaves and axes bear numerous glands, recalling those of *Pinguicula*, to which insects adhere. The leaves are 27 cm. × 2½ mm. at the base, narrowing to 1 mm. at the middle, ending in a bulbous expansion. The histological

details, of singular interest, recall those of *Pinguicula*, and show no affinity to *Droseraceæ*. Moreover, the stamens are introrse, the corolla is sympetalous, the ovary bilocular, and the placentation axile, and the ovules have, as in Corolliforæ generally, but one integument, and a tapetum around the embryo-sac. Haustoria are developed, as in the previous genus, at both ends of the embryo-sac. Hence the author regards this genus as a member of the *Lentibulariaceæ* with radial flowers.—*M. H.*

MANURING POTATOS.

Potatos, Manuring of Swedes and. Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 27–30; June 1901).—The information with regard to the manuring of Potatos is here appended in full detail :—

"The results on five of the farms (in one case the soil proved unsuitable for the experiment) showed that a dressing of $1\frac{1}{8}$ cwt. sulphate of ammonia, $1\frac{3}{4}$ cwt. superphosphate, and $\frac{3}{4}$ cwt. sulphate of potash, costing 28*s*. per acre, proved to be a very profitable addition to 12 tons of farmyard manure, and slightly more profitable than double the quantity of artificials. The most profitable mixture of artificials for use without dung consisted of $2\frac{1}{4}$ cwt. sulphate of ammonia, $3\frac{1}{2}$ cwt. of superphosphate, and 3 cwt. of sulphate of potash. This mixture cost 54*s*. 6*d*. per acre. It seems probable that it would have been more profitable than it was if $\frac{1}{2}$ cwt. nitrate of soda and 1 cwt. fish-meal had been substituted for 1 cwt. sulphate of ammonia; the profits yielded by it were, however, greater than those obtained from dung and artificials. These experiments, and those made in the previous year, indicate that when the Potato occupies a portion of the fallow break, dung should be used; when it does not, farmyard manure may often with advantage be omitted, and artificial manures only used.

"In the absence of dung, heavy dressings of sulphate and muriate of potash have proved advantageous; heavy dressings of kainit have, on the other hand, somewhat decreased the yield. In two instances it was noticeable that kainit hastened ripening. In both these cases the percentage of dry matter in the potato crop was much reduced. On each of the five farms, and also at the College farm, the use of kainit lowered the percentage of dry matter. The average reduction amounted to 2·88 per cent. of dry matter, which means that the food-value of eight tons of potatos grown with kainit was, on the average, no greater than seven tons grown with sulphate of potash.

"Experiments in the manuring of potatos were also repeated in the past year at twelve centres in Lancashire, under the direction of Mr. F. P. Walker, the Agricultural Lecturer of the Harris Institute, Preston. The object of these experiments was to ascertain the comparative effects of a dressing of twenty tons and ten tons respectively of farmyard manure, and the results of applying artificials with a moderate dressing of dung.

"The results showed that the heavier dressing of dung produced an increase of crop which left a substantial profit, and they confirmed the general experience obtained at the various experimental centres in connection with other agricultural colleges, that potatos are a crop which respond in a remarkable degree to large applications of farmyard manure.

In farm practice, however, in the majority of cases, sufficient farmyard manure cannot be spared to give such heavy dressings, and it is therefore important to note that in these experiments, as in those previously reviewed in this *Journal*, a dressing of 10 tons of dung with a complete mixture of artificials gave a very profitable return. The best mixture consisted of 4 cwts. superphosphate, 1 cwt. sulphate of potash, and 2 cwts. sulphate of ammonia. It was noted that there was less disease among the potatos where potash was added to the mixture of artificials.

"Mr. Walker points out that in generalising on the effects of the various manures on the potato crop, he has taken the average of all the centres, but he recommends those who are interested in the subject to study carefully returns from centres situated in their own district, as it is well known that the nature of the various soils and climatic conditions have much to do with the effect of artificial manures. He adds, moreover, that the results have been affected in no small degree by the use of different varieties of potatos at the several centres, inasmuch as some varieties, *e.g.* 'Up-to-date,' respond in a greater degree than others, *e.g.* 'Main Crop,' to heavy manuring, and future experiments should, in his view, be conducted with special reference to this point."—*R. N.*

PRIMULAS.

Primulaceæ, Anatomy of. By E. Decrock (*Ann. Sc. Nat., Botan.* t. xiii. p. 1; 90 figures; 1901).—This paper of 200 pages gives a summary of five years' work, the full account of which is in preparation as a monograph. The method has been applied to many natural orders, to examine the internal structure of as many species as possible, to compare the results, and to deduce the general features or differences of the group. Montpellier, where the work was done, is well situated for a study of *Primulaceæ*, so that not only dead but many living plants have been examined. The paper is divided into four parts:—(1) review of literature; (2) the general anatomy of the order; (3) the general histology of the order; (4) descriptive anatomy of the genera and species examined. From its general anatomy the order falls into two groups, *Primula* the type genus of one, *Lysimachia* of the other; the distinguishing characters of the two groups are given in a summary (p. 56). The part on general histology is a review of the epidermal, the fundamental, and the conductive systems. The descriptive anatomy gives details of species examined. A convenient summary gives in a few pages some interesting results. The *Primulaceæ* are essentially moisture-loving (hygrophilous) plants like *Primula*, but there are a few xerophytes suited to dry conditions; the genus *Androsace* includes a series from hygrophilous to xerophytic. M. Decrock does not agree with the alleged existence of polystely in the stem of some species.—*W. G. S.*

RESIN STRUCTURES.

Resin and the Resin-producing Structures in the Polypodiaceæ and a few Phanerogams, The formation of. By Dr. F. Höhlke (Berlin) (*Beih. Bot. Cent.* bd. 11, ht. 1, pp. 8–45; 3 plates).—A very important description and discussion of everything connected with

the formation of resin; the idioblasts scattered in the ground-tissue, the various intercellular resin-holding canals and cells, and the epidermal hairs, glands, &c., being very fully treated. The resin is regarded as a final product of metabolism. The taste or smell is of importance as either attracting insects or preventing injurious insects or animals from touching the plant. In many buds resinous bodies assist in keeping down the transpiration of the younger leaves.

The chief results were as follows:—Resin-secreting glands only were discovered in the *Polypodiaceæ*. The internal glands were unicellular trichomes, except the schizogenous resin-ducts in *Aspidium athamanticum*. The epidermal glands were sometimes multicellular, but with a single cell at the tip. Internal glands were found in a great number of cases, *Aspidium filix mas*, *A. spinulosum*, and nine other species. They occurred in the rhizomes, bases of petioles, petioles and leaf-segments. These internal gland-hairs possess a cuticle; the resin is secreted between this and the inner wall. In the gland-hairs of *Gymnogramme* species resin is found on the outer surface.

Epidermal resin glands were found either on the epidermis of the petiole, on the leaf-segments, on the scales, on the indusia, or on the sporangia stalks, in a number of species of *Aspidium*, *Gymnogramme*, *Blechnum*, &c. The *Aspleniaceæ* and *Acrostichaceæ* have but few glands, and the *Davalliceæ* appear to be without excretory organs of this kind.

The resin appears to arise in most cases by a change of the lamellæ of the membrane, though in some cases by an excretion of the cell-membrane. It is always produced by the cell-wall.

The author also describes resin secretion in *Senecio viscosus*, *Ononis spinosa*, *Pelargonium zonale*, and *Erodium cicutarium* with a view to showing that in these cases also (not as suggested by Behrens) the resin is formed from the cell-wall.—*G. F. S.-E.*

FRUIT OF SCROPHULARIACEÆ.

Scrophulariaceæ, The Anatomy of the Fruit of. By A. Weberbaur (*Beih. Bot. Cent.* bd. x. ht. 7, pp. 394–457, Table I).—The writer describes the exact character of the dehiscence of the capsules and anatomical details for about 140 genera of this order. In by far the most cases, one or several layers of woody cells are arranged on the inner side of the fruit-wall. Thin-walled cells occur on the outside, the woody and thickened layers being either the innermost layer or the next to it. A description is given of the types upon which those fruits which show imbibition movements are constructed. The imbibition movements depend upon the contractions and expansions of the radial walls, whilst similar contractions and expansions in the tangential direction are unusual. The capsules generally open when dried and close if moistened, generally by a curving outwards, though in a few cases by an inward curvature. In some cases, however, the capsules open and let the seeds escape when they are moistened. This occurs in *Aptosimum*, some *Veronica* sp., *Monttea*, *Lafuentea*, *Striga*, &c. Most of these are desert plants. *Melampyrum* fruits open through the growth of the seeds which fall close to the plant. Ants carry the seeds of this plant. In *Verbascum* the seeds are contained in the capsules all winter, and probably only escape

when the capsule-wall decays. Thus the seeds are preserved in a position where air can reach them and they are protected from moisture. *Tozzia alpina* has much starchy material in the outer part of the fruit. This is undoubtedly adapted to distribution by animals, perhaps by ants.

G. F. S.-E.

SEASIDE PLANTS.

Seaside Plants in Germany, The Distribution of. By Dr. F. Höck, in Lückenwalde (*Beih. Bot. Cent.* bd. x. ht. 6, pp, 367–389).—The paper is well worth examination by British systematic botanists, but it is difficult to give in a condensed form any satisfactory account of details.

(1) The following plants extend to the Arctic regions:—*Glyceria maritima, Hordeum arenarium, Polygonum Raii, Atriplex Babingtonii, Honckenya peploides, Cochlearia anglica, C. officinalis, C. danica, Cakile maritima, Lathyrus maritimus,* and *Armeria maritima.*

(2) The following occur neither in the Mediterranean nor in the Arctic region:—*Kœleria albescens, Carex trinervis, C. punctata, Scirpus Kalmusii, Juncus anceps* var. *atricapillus, Echinopsilon hirsutum* var. *glabrescens, Crambe maritima,* and *Statice bahusiensis.*

(3) Mediterranean and west coast of Europe plants extending to Southern Sweden, Denmark, or North Germany:—*Psamma arenaria, Triticum pungens, Carex extensa, Juncus pygmæus, Atriplex portulacoides, Eryngium maritimum,* and *Convolvulus Soldanella.*

(4) The following extend from the Netherlands to the Mediterranean:—*Alopecurus bulbosus, Euphorbia Paralias, Trifolium maritimum,* and *Trigonella ornithopodioides.*

(5) Species generally found on the coast, but also occurring inland:—*Phleum arenarium, Hordeum maritimum, Triticum junceum, Lepturus incurvatus, Juncus maritimus, Atriplex littoralis, Sagina maritima, Lepidium latifolium, Statice Limonium,* and *Plantago Coronopus.*

(6) Seaside-Steppe plants of Middle Europe:—*Triglochin maritimum, Hordeum secalinum, Scirpus Tabernæmontani, Juncus Gerardi, Asparagus officinalis, Atriplex hastata* var. *triangularis, A. laciniata, A. pedunculata, Corispermum intermedium, Salicornia herbacea, Suæda maritima, Salsola Kali, Spergularia salina, S. media, Melilotus dentatus, Trifolium fragiferum, Lotus siliquosus, Althæa officinalis, Apium graveolens, Bupleurum tenuissimum, Œnanthe Lachenalii, Glaux maritima, Samolus Valerandi, Erythræa littoralis, Plantago maritima, Linaria odora, Aster Tripolium, Artemisia maritima, Tragopogon floccosus.*

(7) Alpine-Arctic species:—*Scirpus parvulus, S. rufus, Salix daphnoides, Rosa pimpinellifolia, Hippophae rhamnoides.*

The first to the fifth of these divisions are regarded as the association of the North German strand-plants; (6) and (7) are considered separate associations.—*G. F. S.-E.*

THE INFLUENCE OF STOCK UPON SCION.

Stock upon Scion, The Influence of. By J. Burvenich (*Rev. Hort. Belge,* t. xxvii, p. 257).—The author first alludes to the taste of pears

being decidedly altered, as of the variety *Zéphirin Grégoire.* If the pear be grafted on *Pyrus Aucuparia* L., the fruits always acquire a harshness characteristic of the latter. Thus, the very sweet variety *Durondeau** (*Poire de Tongre*) acquired an acrid flavour when grafted on this *Pyrus.*

A second influence is the hastening the maturity of fruits naturally slower to ripen when grafted upon more precocious stocks. The author names several varieties in illustration.

In the case of a vine, *Chasselas de Fontainebleau,* grafted with *Vroege Van der Laan,* which is subject to dropping its fruits, the grafted vine never lost any, but it affected the stock, which then regularly dropped its fruit.

The size of the fruit has been altered when an Apple bearing small fruit has been grafted on a scion which bore large ones. The volume was increased on the scion; the converse was equally true. These results were repeated for four years in succession.

The Peach grafted upon an Almond stock perished with a temperature of $-12°$ to $-15°$ C., but on the Plum (*Prunus domestica* L.) it could withstand $-18°$ to $120°$ C.

The kernels of Peaches from trees with purple-coloured leaves give 95 per cent. of the same, but if taken from the trees grafted upon the Peach or Plum only about 30 to 40 per cent. will have coloured leaves. Similar results follow from the Beech, Hazel, Birch and Plum.

If a red-flowered *Camellia* or *Azalea indica* be grafted with a white-flowered variety, many bear striped flowers.

The weeping *Gleditschia Bujoti,* Hort., will not stand frost in Belgium, but when grafted upon the hardier *G. triacanthos* L. it can do so in ordinary winters.

Thuya Verræneana, with yellow leaves (derived from *T. occidentalis*), has a pyramidal form, but if grafted on *Biota aurea,* of a more rounded shape, it assumes the same character.

Many variegated shrubs revert to an entire green in their leaves, but the author noticed some variegated Hollies, grafted upon rooted cuttings of variegated Hollies, which failed to turn green (as others not so grafted did in the same garden) for ten years.

Cotoneaster buxifolia and *C. Simonsi* have evergreen leaves, but when grafted upon *Cratægus Oxyacantha* they became deciduous.

Certain varieties of Apple are very subject to canker, others not so; but if the latter be grafted on the former the disease appears upon them.

On the other hand, if varieties of 'Raisin,' which are delicate and liable to disease, be grafted on the vigorous and sound 'Frankenthal,' they become completely "regenerated."

If the laciniated variety of Walnut be grafted upon the common form, the leaves of the scion become less laciniated, or it may even bear leaves with entire leaflets. Similar results have occurred with many other trees, as Nut Hornbeam, Oak, Birch, and Alder.—*G. H.*

* *Durondeau,* or *De Tongre,* is an unfortunate example to have chosen, as in England at least no one could call it a "very sweet" pear, and the very thin layer immediately underneath the skin is often, if not generally, inclined to be a little acrid.—ED.

VINES.

Vine, Investigations on the Ripening of the Canes in. (Recherches Biologiques sur Aoûtement des Sarments de la Vigne.) By F. Kövessi (*Rev. gén. Bot.* xiii. p. 193, with plates 8–9, and figures in the text).—The author discusses the various characters, both external and anatomical, which distinguish well-ripened from badly-ripened canes of the vine, and points out the very different values they respectively possess as either materials for grafting or as fruit-bearers. The vines chiefly dealt with are the various races of *Vitis vinifera* and *V. rupestris*, the latter of which has been used in some parts of France to replace the sorts killed out by the phylloxera.

Dealing with the anatomical differences, he points out that in well-ripened canes the elements of the woody tissues possess thick walls as contrasted with those of the pith and of the cambium. In badly-matured specimens this difference is less well marked, and the degree of its accentuation may be taken as a guide in estimating the completeness with which the ripening processes have been carried through. This relation between the character of the cells and the condition of matureness is preserved under whatever kind of environment the plants to be compared may have been cultivated.

Again, the starch-grains, which are stored in the tissues as reserve food, exhibit a disparity in average size which is related to the condition in question of the canes, being larger in those which have been properly ripened, and a similar difference is shown between the total amount of reserve food per unit weight of the two kinds of stems. Thus specimens gathered and investigated in winter showed a difference exceeding 50 per cent. between the amount of food stored in corresponding parts, measured by volume, of well- and badly-ripened canes.

M. Kövessi then deals with the influence of the various external factors which are concerned in bringing about this difference, and considers them also in relation to the inherent character of the different varieties of the vines which were investigated. Foremost amongst the external influences is naturally that of climate, involving as it does the factors of heat, light considered both with regard to intensity and duration, and the humidity of the air and the soil.

Interesting details as to the relations between temperature and growth are given. Thus it was found by Angot that in the case of the ordinary vines, a daily average temperature of 12° C. suffices to cause the buds to push, and correspondingly in autumn, when the average temperature sinks to the same degree, the leaves fall off. Hence it is clear that, other things being equal, a consideration of the temperature curves for any given locality may indicate its relative suitability for the cultivation of the vine. For if the minimal temperature is reached earlier in one place than another, and in the autumn is similarly postponed, the period of vegetation will likewise be correspondingly lengthened.

The importance of the internal factor, which must always be borne in mind in dealing with statistics of this kind, is emphasised by the behaviour of the Pinot variety of vine, which is cultivated in the North of France. For its minimal temperature is 10° C., or two degrees lower

than that required by the more southern-growing sorts, and the proximate cause of its special suitability is thus at once indicated.

The author remarks that the optimal temperature for ripening the wood is not necessarily identical with that for the development of the vegetative organs. Thus, to quote a specific instance, growth was most pronounced at 18° C., whilst the best tissue-differentiation (*i.e.* ripening) occurred at 22° C. Possibly, however, the restraining influence of intense light on growth was not sufficiently taken into account here, for the higher temperature involves a more intense insolation. It may well be that, had the *intensity of the light* been kept constant, the growth would have been more rapid and pronounced at 22° than at 18°. At any rate such considerations may serve to point out the complex nature of the interacting factors even in cases apparently simple. The effects of the rainfall, and especially of its distribution, are also reviewed, and the direct action as affecting the soil and nutrition of the plant is considered, as well as the more indirect result of the diminished light arising from an evenly-distributed rainfall. The latter influence is strikingly illustrated by the meteorological conditions which prevail in the north and south regions of France respectively.

The effects of subsoil water are shown by its influence on the vines in certain areas around Montpellier, in which, in spite of the generally admirable climate, the vines do not properly ripen on the affected spots. The contour of the land and other local conditions also exert their due influence, and the chemical nature of the soil, especially in connection with manures, is also a matter for consideration. Excessive nitrogenous manuring, as might be expected, encourages rank growth, but is unfavourable to ripening, whilst phosphates and lime in moderation are used with beneficial effect. Diseases which influence the leaves and other vegetative organs are of course injurious, whilst those (*e.g.* cases of black-rot) which may be confined to the fruit do not appear to exert any material influence on the process.

The memoir is illustrated by useful figures and charts which render it easy to appreciate the various points raised by the author in his important contribution to agricultural physiology.—*J. B. F.*

ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

(*See also page* 199.)

Acanthaceæ, African. By Spencer Le M. Moore (*Journ. Bot.* 465, p. 300; 9/1901).—Descriptions of the following new species: *Thunbergia Elliotii, Blepharis extenuata, B. Scullyi, Neuracanthus gracilior, Justicia Taylorii, J. Baumii,* and *J. Smithii.*—*G. S. B.*

Acclimatisation, Effect of Last Winter on Various Plants (near Dantzig). By R. Müller (*Gartenflora*, p. 402; 1/8/1901).—Last winter was more destructive than any of the previous thirty years, apparently on account of (1) the exceptionally mild weather at the end of December, followed immediately by a rapid decrease of the temperature

to. − 21° R.; (2) the bright sunshine every day between 11 and 2 o'clock; and (3) the absence of a covering of snow. The effect of the season on a number of shrubs and trees is described.—*J. P.*

Acclimatisation of Foreign Plants (*Rev. Hort. Belge*, t. xxvii. p. 198; September 1901).—As examples, the Japanese Medlar first fruited at Hyères, then in the colder climate of Montpellier; Kaki and Japanese Plums are well acclimatised in the south of France.—*G. H.*

Aerides multiflorum and its Allies. By R. A. R. (*Orch. Rev.* p. 242; August 1901).—A most interesting article, dealing with the various species connected with this group of Eastern plants.—*H. J. C.*

Agapanthus caulescens (*Gartenflora*, p. 281, fig. 1487; 1/6/1901). - A plate and brief description of a new species of *Agapanthus* from the Transvaal.—*J. P.*

Agave attenuata. By J. N. Rose (*Rep. Miss. Bot. Gard.* vol. xi. p. 79; 1900; plate 7).—Re-description of a second specimen of this species, flowered in the Botanical Garden at Washington in 1898.—*G. S. B.*

Agave expatriata. By J. N. Rose (*Rep. Miss. Bot. Gard.* vol. xi. p. 79; 1900; plates 9 and 10).—Description of a new species in the *Marginatæ* group, flowered in the Botanical Garden at Washington in 1898, of unknown origin.—*G. S. B.*

Agave heteracantha. By J. N. Rose (*Rep. Miss. Bot. Gard.* vol. xi. p. 79; 1900).—The tentative name represents an aggregate of several species, probably from Northern Mexico, but is described; while *A. Lechuguilla* is discriminated by its very long terminal spine.—*G. S. B.*

Agave Treleasii. By J. W. Toumey (*Rep. Miss. Bot. Gard.* vol. xii. p. 75; 1901). Plates 32-3.—Description of a new species related to, and associated with, *A. Schottii* at an altitude of about 6,500 ft., in Southern Arizona, and used locally as a substitute for soap.—*G. S. B.*

Agave Washingtonensis. By J. N. Rose (*Rep. Miss. Bot. Gard.* vol. xi. p. 79; 1900; plate 8).—Re-description of the specimen of this species that flowered in the Botanical Garden at Washington in 1897 and 1898.—*G. S. B.*

Agricultural Conference, 1901 (*Qu. Agri. Journ.* vol. ix. pt. 1; July 1901).—Reports of the Conference, chiefly on subjects connected with agriculture, "The Fruit Industry of Queensland" and "The Orange Industry in the Maroochy District," and "Pine-apple growing," being the only horticultural articles.—*M. C. C.*

Albugo, Gametogenesis and Fertilisation of. By F. L. Stevens (*Bot. Gaz.* vol. xxxii. pp. 77–98; plates 1–4; No. 2).—*G. H.*

Alkali Studies (*U.S.A. Exp. Stn. Record*, vol. xii. No. 11, 1901, p. 1008).—Notes in regard to the effects of alkali on plant germination and growth, the rapidity with which salts in solution were absorbed, and the amount of water evaporated from plants and salts in solution.

E. F. H.

Alpine Plants, Rare. By S. Arnott (*Gard. Mag.* 2,484, p. 367; 8/6/1901).—*Ramondia serbica* var. *Nathaliæ*, *Androsace sarmentosa* var. *Chumbyi*, *Veronica Balfouriana*, and others are described, and useful notes are given of their culture in the writer's garden near Dumfries.—*W. G.*

Amaryllis (Hippeastrum) procera. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 7, p. 199; July 1901).—This species is known to be difficult of flowering. It is a native of Brazil. During the summer it should be kept in the open air in a ventilated but very insolated position; in the beginning of autumn it should be transferred to a temperate greenhouse and exposed to full light. Following this treatment the plant will flower easily the next spring. The bulb is much elongated, appearing like a tunicated shoot, which is persistent, swollen at the base, 60 cm. to a metre high, resembling somewhat the shoot of a *Crinum*, bearing several broad, long, recurved leaves at the summit. The flowering shoot is short, proceeding from the centre and bearing many flowers. The latter are disposed horizontally; the five petals form a tube 15 cm. long, somewhat widened at the end, where the petals are prolonged into acuminate teeth. The flower is of a violet-pink colour, with reticulate nervation.—*W. C. W.*

America, Central. By Mr. J. Donnell Smith (*Bot. Gaz.* vol. xxxi. p. 108; No. 2).—Describes nearly thirty new species of nearly as many genera.—*G. H.*

American Florists, Society of.—Report of Proceedings of the sixteenth Annual Convention at New York City, August 1900 (175 pages), including president's address; report of the ladies' drive on the afternoon of the first day and evening lecture on floral decoration. Second day's proceedings, including paper and discussion on greenhouse construction and evening lecture on American floriculture. Third day's proceedings devoted especially to the Carnation. Fourth and last day to sports. Gives a very good idea of how American horticultural societies are run.—*D. H.*

Analysis of Ash of Cabbage Plants. By Zawodny (in Berlin) (*Beih. Bot. Cent.* bd. 11, ht. 1, p. 46).—Three tables are given in this paper showing the differences in percentages of various minerals in plumules, radicles, testa, and leaves and roots. The following may serve as an example:—

	Seedlings grown in Laboratory			Plants grown in Soil		
	Plumule	Radicle	Testa	In Solution in water	Leaves	Roots
Iron-oxide	1·30	6·13	5·59	1·95	2·05	8·17
Calcium	9·24	8·13	49·44	5·56	35·24	29·70
Magnesium	11·54	6·13	10·74	3·58	8·41	7·42
Potash	15·44	36·80	6·71	41·36	22·51	17·07
Soda	0·00	Trace	Trace	2·62	3·41	7·42
Phosphoric acid	38·67	26·53	8·50	12·84	9·92	9·44
Sulphuric acid	23·81	16·27	12·53	22·73	11·10	11·13
Chlorine	Trace	Trace	Trace	9·01	5·00	—
Silicic acid	Trace	Trace	6·49	0·35	2·35	9·65

The other tables deal with the difference in ash-analysis of large and small plants and with kohl-rabi corms and roots.—*G. F. S.-E.*

Andes, Plants from the Bolivian. By W. B. Hemsley and H. H. W. Pearson (*Jour. Linn. Soc.* vol. xxxv. pp. 78–90).—Remarks on a collection of dried plants made by Sir Martin Conway in the Bolivian Andes in 1898–99, containing forty-six species; the names of these are given, and the localities and altitudes in which they were found. Eight of them occurred at or above 18,000 feet, and two at an elevation of 18,700 feet above the sea-level. The flora of the higher regions "appears to be very sparse, but it is only fair to say that the rainy season must be the time when the flowers are most numerous, and as we quitted the country before the actual commencement of the rains, we probably only encountered the earlier flowers." "Omitting introduced species, the Conway collection contains thirty-eight species from 12,000 feet and above; these are distributed among thirty-one genera and twenty-one natural orders." Rather more than one-third of the whole number of species belong to the Compositæ, which is the only order represented by more than two species. Allusion is made to the collections formed by previous visitors to these regions, more particularly to those of Weddell, who wrote the "Chloris Andina," two volumes of which only were published.—*G. S. S.*

Androsaces. By M. H. (*Gard. Mag.* 2,487, p. 401; 29/6/1901).—A useful and practical article on the various species of *Androsace*, with description and cultural notes. It will be valuable to those who desire to grow those beautiful Alpine plants.—*W. G.*

Anemone japonica. By Ph. L. de Vilmorin (*Rev. Hort.* p. 380; August 1901).—Coloured plate and woodcut of the species and two varieties; 'Reine Charlotte,' semi-double rose-pink; and 'Whirlwind,' a more double pure white.—*C. T. D.*

Ant Gardens in the Amazon District. By E. Ule (*Engl. Bot. Jahrb.* xxx., *Beibl.* 68, pp. 45–52, t. xxiii.; 2/7/1901).—The author, writing from Manáos, in Brazil, describes the curious form of epiphytism associated with ants'-nests, which he finds remarkably common in the Amazon district. A number of plants belonging to the *Araceæ*, *Bromeliaceæ*, *Gesneraceæ*, and other families were found growing only in the ant-nests on larger trees. The insects apparently carry the seeds to their nests and, as the seedlings grow, carefully cover with humus the young roots. The so-called ant-epiphytes show peculiarities of leaf, root, &c., which distinguish them from other epiphytic species of the same genera; for instance, tubercles may develop on the roots.—*A. B. R.*

Anthurium Andreanum, 'Souvenir d'Edouard Pynaert.' (*Rev. Hort.* p. 250; June 1901).—Spathe pure white, 20 centimetres long, 15 wide; very vigorous; spadix, first light yellow, then pure white.—*C. T. D.*

Anthuriums, Culture of, especially *A. Scherzerianum.* By V. de Coene (*Gartenflora*, p. 326; 15/6/1901).—These are best raised from seeds, which begin to germinate in the ripe red berries of the plant. The seed should be placed on sphagnum moss which has been sterilised by boiling and kept at a temperature of 15° to 25° C., after which the seedlings appear in

about fourteen days. The seedlings are pricked out in leaf-mould and sphagnum and kept at a temperature of 15° to 20° C. In the third or fourth year they flower. After blooming, from March to June, the plants are allowed to rest, little water being given during the summer until about August, when growth may be re-started by supplying more water and a warm, damp atmosphere. The pots should be well-drained and filled with peat and wood charcoal or peat and potsherds, the latter being best.—*J. P.*

Antirrhinum majus, Forcing of. By H. Dauthenay (*Rev. Hort.* pp. 341, 342; July 1901).—Two woodcuts.—*C. T. D.*

Apple Blossoms, Origin and Development of. By E. S. Gffo (*Trans. Illinois Hort. Soc.* 1900).—A short paper of much practical interest, followed by a report of the discussion that followed the reading of the paper.—*D. H.*

Apple Bulletin. By T. K. Bruney (*U.S.A. St. Bd. North Car.* 1900; 4 coloured plates, one map, and 18 illustrations of pests).—After giving information as to suitable trees for Western State cultivation, useful notes by G. E. Boggs are given on the care of trees, thinning the fruit, and gathering and marketing the fruit. Also an interesting letter from W. F. Grabs on care in handling winter Apples. The bulletin concludes with an excellent summary of the diseases and insects affecting Apple-trees in North Carolina, with suggestions for their destruction.—*D. H.*

Apple 'Rhode Island Greening.' By G. E. Adams (*Amer. Gard.* xxii. pp. 599, 600; 31/8/1901).—A contribution to the history of Rhode Island's famous apple.—*C. C. H.*

Apple Scab Fungus. By T. J. Burrill (*U.S.A. Hort. Soc. Ill.*; 2 plates, 1900).—An account of the life-history of *Fusicladium dendriticum* Fckl., including an account of some of the (as then) unpublished results of experiments by G. P. Clinton. Much information about methods and times of spraying is given in the paper and in the discussion that followed. *D. H.*

Apple, Structure and Varieties of the. By Prof. Lazenby (*U.S.A. Hort. Soc. Ohio*, 1900).—A short paper dealing especially with richness and flavour in the Apple fruit. According to this author the following are the qualities demanded in a good Apple by the American public at the present time: First, bright colour; second, moderate and uniform size; third, uniform shape; fourth, richness; fifth, a spicy flavour; sixth, firm, but tender and melting flesh; seventh, a small core with few seeds; eighth, a smooth, thin skin; ninth, good keeping qualities; tenth, good cooking qualities.—*D. H.*

Apple-Tree Insect Pests. By E. Dwight Sanderson (*U.S.A. Penn. Hort. Soc.* part ii. 1901, figs. 1–35, pp. 3–52).—Gives an account of twenty-nine insect pests, dividing them into those which injure the roots, those injuring the trunk, those injuring the twigs, those injuring the

buds, those injuring the leaves, and those injuring the fruit. Means of preventing their attacks are also given. (See also "Insects.")—*F. J. C.*

Architects and Gardens. By H. P. G. Maule (*Gard. Mag.* 2,486, p. 391; 22/6/1901).—A paper read before the Architectural Association. It deals chiefly with the relation of the architect's work and the garden, a subject that has often before given rise to discussions. The paper deserves perusal by those interested in the subject.—*W. G.*

Arctotis Gumbletoni, Hook. fil. By Sir J. D. Hooker (*Bot. Mag.* tab. 7796).—Nat. ord. *Compositæ*; tribe *Arctotideæ*. Native of Namaqualand. Stem and pinnately-lobed leaves tomentose. Flower heads 3 inches across, bright orange, with four united red-brown streaks at the base of the corolla.—*G. H.*

Arctotis Species, Reizbare Griffel v. zwei. By M. von Minden (*Flora*, vol. lxxxviii. Pt. 2, pp. 238–242; March 1901).—*Arctotis aspera* and *A. calendulacea*, garden plants from S. Africa, have styles which are irritable to contact, bending over to the side touched.—*M. H.*

Arctotis stœchadifolia (grandis). (*Gard. Chron.* No. 763, p. 108, fig. 34; 10/8/1901).—A dwarf shrubby composite, stems and leaves covered with a grey down. The latter are in form somewhat like an oak-leaf, but much larger; the Daisy-like flowers are about four inches in diameter; the ray florets are whitish shaded with lilac. It was introduced in 1799, but had dropped out of cultivation until quite recently.
G. S. S.

Asparagus as an Ornamental Plant. By H. R. Hayle (*Gard. Chron.* No. 758, p. 341; 1/6/1891).—The names and descriptions of the best species for decorative purposes are given.—*G. S. S.*

Asparagus Rust (*U.S.A. Exp. St. Hatch*, Report 12, 1900–1). —The principal feature emphasised in these experiments is, that the summer stage is due to a weakened condition of those plants growing on dry soil, during seasons of extreme drought. (See also p. 501.)—*M. C. C.*

Assimilation of Carbon Dioxide in Ulva latissima, L., Effect of Salts on. By E. A. Newell Arber, B.A. (*Ann. Bot.* xv. No. lvii. p. 39).—In recent work there has been a tendency to call greater attention to the importance of inorganic salts for the maintenance of carbon assimilation, and the author says that the primary object of his research was to obtain "some idea of the extent to which the power of carbon assimilation is dependent on the absorption of nutrient salts, and of the inhibition caused by the presence or absence of certain salts in the medium." Very important results are obtained, as for instance that common salt is found to be absolutely indispensable for even a moderate amount of carbon assimilation in *Ulva*. No other salt can take its place. Calcium sulphate and potassium chloride, in distilled water, inhibit carbon assimilation almost completely.—*R. I. L.*

Aster Diseases (*U.S.A. Exp. Stn. Hatch, Reports* 12 and 13, 1900–1). —G. E. Stone and R. E. Smith complain of the trouble of growing Asters

on account of disease. The most prominent, a disease of obscure nature which experiments indicate to be due to a disturbance of the assimilative functions of the plant. At least three other diseases, all of a fungoid nature, attack the plant, with serious effects. Complaints from all parts of the country of trouble in growing this flower.—*M. C. C.*

Astrophytum myriostigma, Lem. By Bedinghaus (*Rev. Hort. Belge*, t. xxvii. p. 170, No. 8; August 1901).—This was discovered in 1837 in N. Mexico. It flowered at Brussels for the first time in 1839. The specific name refers to the myriads of little white spots upon it. The stem is nearly globular, with five ribs. From this species M. l'Abbé Beguin has obtained several hybrids, of which nineteen are briefly described.—*G. H.*

Atriplex semibaccatum. "Salt Bush," *Australasian* (*Agr. Jour. Cape G.H.* vol. xviii. No. 13, pp. 867–868; June 1901).—Mr. H. W. Potts, Government dairy expert, during a recent visit to Koondrook and Cohuna, found that dairy cattle had thriven on this plant and had given good milk returns. "The plant is found in all the Australian States right into the interior."—*R. N.*

Australia, Plant Disease in (*Dep. Agr. Vict. Rep.* 1899).—The list includes the well-known Apple scab (*Fusicladium dendriticum*), a new disease of the fruit, called "eye scab," attributed to *Sporidesmium cerebriforme*. The usual European diseases on Cauliflower, Celery, Clover, Flax, Peach, Nectarine, Fig, Strawberry, Tomato, &c., with bacteriosis on the Mulberry; a new disease of Lettuce, *Fusarium Lactucæ*; and the appearance of cluster-cups (*Æcidium Cinerariæ*) upon the leaves of cultivated Cinerarias. Other well-known diseases are enumerated for Carnations, Roses, Hollyhock, Violet, and Mignonette.
M. C. C.

Australia (South), Introduction of Trees, Plants, and Fruit into, Regulations relating to (*Agr. Gaz. N.S.* vol. xii. Part 5, p. 576).—The attention of all interested is directed to the following regulations issued by the Agricultural Bureau of South Australia:—

The introduction into South Australia of grape vines and any portions thereof, from any country or place, is absolutely prohibited.

Living trees, plants, or portions thereof (not being grape vines or portions thereof), and fruits (not being grapes) may be introduced into South Australia from any country or place under and subject to these regulations, but not otherwise.

Living trees, plants, and portions thereof (not being fruit) shall (unless sent by post) only be introduced into South Australia at Port Adelaide.

All living trees, plants, or portions thereof, intended for introduction into South Australia must, prior to being landed or introduced, be thoroughly cleansed of soil: provided always that any inspector may admit plants growing in pots, if in his opinion there is no danger in importing them.

No person shall keep or sell, or expose or offer for sale, or in any manner cause the distribution of any living insect of the kind prohibited

in any stage of its existence, or any tree, plant, or fruit infested with or affected by any insect or disease.—*A. W. S.*

Beans cultivated as Esculents. By H. C. Irish (*Rep. Miss. Bot. Gard.* vol. xii. p. 81; 1901). Plates 38–47.—A detailed revision, with descriptions, keys, synonymy and figures of all the seeds of the esculent varieties of *Phaseolus lunatus, P. vulgaris, P. multiflorus, Dolichos Lablab, D. sesquipedalis, Vigna Catjang, Glycine hispida* and *Vicia Faba*, with notes on diseases, culture and cooking.—*G. S. B.*

Beet Sugar Industry in the United States (*U.S.A. Dep. Agr.* No. 69; 1901).—Reports upon the extent of the Beet Sugar Industry in the United States, and the pests and diseases to which the plant is liable, the chief attention being given to the "Bacterial Disease of the Sugar Beet." Beyond this the ordinary leaf-spot (*Cercospora*) is mentioned, and the large leaf-spot (*Phyllosticta*).—*M. C. C.*

Begonias, Crested. By A. v. d. H. (*Rev. Hort. Belge*, t. xxvii. p. 250; Col. pl. and 5 photogr.).—Briefly referring to the origin of our present Begonias in the three species *boliviensis, Veitchii*, and *Pearcei* (1866), one of the first "double" appeared in 1875, "François Desbois," with twelve petals. But the novelty now shown by photography is called *erecta cristata.* The flower is some 4 inches in diameter, the four large white petals being strongly crested down the middle with golden excrescences, the stamens being replaced by smaller, totally yellow petals, but not crested. In another the petals are crested, but the stamens are present. A third illustration shows a double flower spotted, and a fourth striated.—*G. H.*

Begonia gogocensis × heracleifolia. By G. Bartsch (*Die Gart.* p. 89; 26/10/1901).—Very interesting new decorative hybrid Begonia. Well recommended.—*G. R.*

Begonia hybrida 'Gloire de Lorraine' and its white variety 'Caledonia.' By L. Wittmack (*Gartenflora*, p. 393; coloured plate and fig. 60; 1/8/1901).—Description of both varieties.—*J. P.*

Begonia semperflorens. By A. Voigt (*Die Gart.* p. 613; 28/9/1901).—An exhaustive article (and well illustrated) describing the many forms of *B. semperflorens*, with cultural notes.—*G. R.*

Begonia semperflorens Novelties. By De Coene (*Die Gart.* p. 616; 28/9/1901).—With figures and descriptions of several new French and German, single and double forms, adapted for bedding out and pot culture, much used on the Continent.—*G. R.*

Begonias, 'Vernon,' with variegated leaves. By Ch. Grosdemange (*Rev. Hort.* p. 262; June 1901).—Origin and description, with woodcuts, of two new Begonias, one dwarf and the other normal size, raised from 'Vernon' strain, both largely variegated with white, and named respectively 'Edmond Poiret' and 'President Deviolaine.'

C. T. D.

Berberis. By G. Gordon (*Gard. Mag.* 2,502, p. 659; 12/10/1901).—A descriptive account of the best species and varieties of *Berberis*, evergreen and deciduous, for general cultivation. Illustrations are given of *B. stenophylla* and *B. Darwini*, as grown in large, unpruned masses. *W. G.*

Bertholetia excelsa, Germination of. By W. Watson (*Ann. Bot.* vol. xv. No. lvii. p. 99).—The seeds of this tree are the Brazil-nuts of commerce. They are contained in a fruit with walls so hard that a sharp saw can only with difficulty cut through them. Moreover, the fruit when ripe is sealed, and how the seeds germinated and produced the tree has been the subject of several hypotheses. The author explains what happened at Kew, and shows by means of photographs what the struggle for existence must be, and how the strongest, or most favourably placed, must finally succeed. The seeds germinate in the closed fruit, and by-and-by the stems struggle out at the exit made by the loosening of the plug at the top.—*R. I. L.*

Beschcorneria Wrightii, J.D.H. By Sir J. D. Hooker (*Bot. Mag.* tab. 7779).—Nat. ord *Amaryllideæ*; tribe *Agaveæ*. The native country is unknown, though the genus is mostly native in Mexico. Flowered at Kew 1900. Leaves 4 to 5 feet long, long-pointed. Panicle of fascicled flowers, with green tube about 1 inch long, and yellow lobes.—*G. H.*

Birds of Farm and Garden. By Helen A. Ball (*U.S.A. St. Bd., Rhode Is., Ann. Rep.* 1899; illustrated).—In this interesting pamphlet the authoress gives a pleasant account of the various birds that assist the farmer, some by devouring insects, others by feeding on the seeds of weeds. Amongst the former the most assiduous are the chickadees, the downy and hairy woodpeckers, and the nuthatch.

The first attacks the canker-worm and the larvæ of the codlin moth. The nuthatch opens nuts for the sake of the worm therein, rather than the kernel, and the woodpeckers destroy the larvæ of borers, wood ants, &c.

The junco, the tree-sparrow (or winter chippy), and the goldfinch live chiefly on weed-seeds, thus lessening the next year's crop. The common crow, the blue jay, and the northern shrike, or butcher-bird, all eat mice, beetles, and harmful insects.

Hawks and owls are very useful in eating mice.

Birds should be encouraged as far as possible, and if fed, to some extent artificially, in very severe weather, will often repay this hospitality by clearing fruit-trees of a large number of dormant pests.

Wild fruit-bearing plants and bushes could be grown round about gardens, when much cultivated fruit would be spared.

A basin or pan of water in some convenient place is also recommended, for it is said that birds often eat succulent garden fruit from a desire to quench their thirst; this, however, is amongst things very doubtful.

C. H. C.

Brodiæa crocea. By J. G. Baker (*Gard. Chron.* No. 764, p. 126, fig. 39; 17/8/1901).—This pretty little plant has been imported from California, and is now figured for the first time. It has an umbel of

yellow flowers, some 6 to 15 inches in height, on a naked peduncle a foot long. It has previously been described under the names of *Seubertia crocea*, *Milla crocea*, and *Triteleia crocea*.—*G. S. S.*

Bugs injurious to our Cultivated Plants. By O. Lugger. (*U.S.A. Exp. Stn. Minn. Bull.* 69; Dec. 1900).—A pamphlet of 259 pages, illustrated with sixteen plates and numerous woodcuts, giving a short account of the *Hemiptera* generally, with descriptions of certain genera in this order which are of little or no interest from an economic point of view; and then of the true bugs which injure our plants, followed by those in the sub-order *Homoptera* (Cicadas, Plant-hoppers, Aphides, and Scale insects) and their natural enemies. Descriptions of the various insects, their habits, and the best methods of destroying them, are given. A valuable contribution to the literature on insect pests; and though most of the insects mentioned are not natives of Great Britain, some are, and those that are not have their prototypes which attack our plants, and which may be destroyed by the same means as the American species.—*G. S. S.*

Buitenzorg Botanic Gardens, Java. By D. G. Fairchild (*Bot. Gaz.* vol. xxxi. p. 423, No. 6).—A description of the gardens and houses in connection with it, as well as notes on some of the plants.—*G. H.*

Bulbophyllum grandiflorum, Blume. By Sir J. D. Hooker (*Bot. Mag.* tab. 7787).—Nat. ord. *Orchideæ*; tribe *Epidendreæ*. Native of New Guinea. Discovered by Zippel in 1828. Flowered at Kew 1900. It is remarkable for the great size of the flower, being about 8 inches long. The sepals are very broad, tesselated with alternate large pale brown and yellow square spots. Petals are very minute, triangular.—*G. H.*

Bulbous Plants in California. By Carl Purdy (*Gard.* p. 455; 22/6/1901).—Climatic condition of the country and systems of culture form an interesting article where bulbous plants are appreciated.—*H. J. C.*

Cacao, Fungi attacking. By J. H. Hart (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 4, p. 422).—The Cacao-tree has its special fungus disease. *Nectria Bainii*, Massee; it is also attacked by *Phytophthora omnivora*, De Bary, a species closely allied to *Phytophthora infestans*—the potato disease. The two are fully described in this paper, and an excellent plate of them given.—*W. W.*

Cacao in West Indies (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 2, p. 152).—Dr. Morris, C.M.G., mentions that "the prosperous little island of Grenada is dependent on Cacao and Spices," and whilst the sugar industry of the West Indies has in the last twenty years decreased by nearly £800,000, the export of Cacao has increased by nearly a million and a quarter sterling.—*W. W.*

Cactaceæ, Structural Studies on. By C. E. Preston (*Bot. Gaz.* vol. xxxii. p. 35, No. 1).—The author describes the anatomy of south-

western (N. America) species, showing how the tissues have become adapted to the environmental conditions.—*G. H.*

Calanthe madagascariensis, Rolfe. By Sir J. D. Hooker (*Bot. Mag.* tab. 7780).—Nat. ord. *Orchideæ*; tribe *Epidendreæ*. Introduced by Mr. Warpur, a Belgian collector; it flowered at Kew 1890. Pseudo-bulbs small, cylindric, and annulate; leaves recurved and ridged between the veins. Perianth white, with a purple, rose-red or yellow lip; 1 inch across, with a slender curved spur.—*G. H.*

Calanthes, Culture of. By W. H. White (*Orch. Rev.* p. 77; March 1901).—A most interesting and valuable treatise on the culture of the various species and hybrids belonging to the deciduous section of Calanthes.—*H. J. C.*

Calcium Oxalate, Probable Function of. By Alb. Schneider (*Bot. Gaz.* vol. xxxii. p. 142).—The author suggests that the prime use is mechanically strengthening tissues, such as bast; as a substitute for sclerenchyma, as supplying elasticity, as preventing injury by pressure, as round air-chambers in leaves, &c. He also refers to Kraus's view, that calcium oxalate is a reserve product.—*G. H.*

California, Studies on Plants of. By H. M. Hall (*Bot. Gaz.* vol. xxxi. p. 388, No. 6; 1 plate).—Describes *Frasera neglecta*, n. sp.; *Asclepias californica*, Green; *Gilia modesta*, n. sp.; *Collinsia callosa*, Parish; *Chænactis Xantiana*, Gray; *C. heterocarpha curta*, Gray; *Erigeron Bloomeri*, Parish; *Eriogonum nudum*, Dougl.; *Aquilegia pubescens*, Coville; *Dodecatheon Jeffreyi redolens*, n. var.; *Erigeron salsuginosus*, Gray; *Phalacroseris Bolanderi coronata*, n. var.—*G. H.*

Cameroons, The Botanic Garden in the. By Dr. P. Preuss (*Gartenflora*, p. 292; 4 illus.; 1/6/1901).—An account of the Botanic Garden in the German colony of the Cameroons, West Africa, by the Director. Experimental plantations of the chief useful tropical plants (cocoa, coffee, vanilla, rubber-trees, &c.) have been made with a view of determining the suitability of these crops for cultivation in the colony.—*J. P.*

Camoënsia maxima, Welwitsch. (*Bull. Bot. Dep. Jam.* vol. viii. p. 88).—An account of this climbing leguminous plant, which bears the largest flower of any plant of the order, the corolla being one foot in length. It is a native of Angola. The flowers are white, edged with gold.—*G. H.*

Canada Thistle. By Lyster H. Dewey (*U.S.A. Dep. Agr., Div. Bot., Circ.* No. 27).—So troublesome a weed has the Canada Thistle become in America that no fewer than twenty-four States have framed laws placing it among the noxious weeds. In the majority of cases a penalty is enforced for allowing seeds to be produced. The more enlightened farmers can readily destroy it, but are greatly handicapped by the ready dissemination of seeds by wind from neglected plots. Mowing before

seeds are formed, and laying down to grass after manuring heavily, have been found successful. In addition, chemical agents may be used, which, although effective, are difficult to apply over large areas.—*E. F. H.*

Canker Fungus, The (*Nectria ditissima*). Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 12 14; June 1901; with a plate, figs. 1–3).—This form of "Canker" is recognised by the characteristic wounds or cracks and swellings made on the branches of various fruit and forest trees. The nature and various stages of the fungus are described and illustrated. It is recommended that all diseased branches should be removed, and "the cut surface luted with clay or protected with a coat of gas-tar." It is further recommended that grafts should not be taken from diseased trees, and that a solution of 1 lb. of sulphate of iron to one gallon of water will kill the "white stage" of the fungus as well as moss and lichens.—*R. N.*

Canker in Apple-trees (*Amer. Gard.* xxii. pp. 412, 413, figs. 89, 90; 8/6/1901).—A popular description of the New York Apple-canker caused by *Sphæropsis malorum.* It is very common in the State of New York and is quite distinct from our European apple-canker (*Nectria ditissima*). The American canker fungus attacks Apples, Pears, and Hawthorn-trees, as well as Apple, Pear and Quince fruits. Sunscalds and mechanical abrasions appear to be necessary to enable the pest to get a foothold. As a preventive of this disease, a thorough spraying with Bordeaux mixture is recommended, together with a good lime-wash, to prevent sunscald. Full details may be found in Bulletin No. 185 of the Geneva (N.Y.) Station.—*C. C. H.*

Canker in Fruit Trees. By M. Passy (*Rev. Hort.* p. 299; July 1901).—Due to *Nectria ditissima*, and not to the woolly aphis, which only prepares a suitable nidus for infection from other infested trees.—*C. T. D.*

Cannas, Large-flowered. By G. G. (*Gard. Mag.* 2,486, p. 238; 22/6/1901).—An excellent account of the best varieties of Cannas, old and new, of which a descriptive note is given of each of the thirty selected varieties. Cultural details are given, and an illustration of the variety 'Oscar Dannecker.'—*W. G.*

Caoutchouc Regions of the Amazon (*Not. König. Bot. Berlin*, No. 26, B. iii.; July 1901).—A report on various india-rubber plants. *M. W.*

Cattleya labiata, var. **Trianæ,** Armand de Meulenaere. By Ch. Pynaert (*Rev. Hort. Belge*, t. xxvii. p. 217, Col. pl.; Oct. 1901).—In the possession of M. le Marquis de Wavrin, whose collection of Orchids is described. The flowers are 6½ inches across the lateral sepals; pale pink, tipped with carmine; the lip, 2 inches long, with crimped margin and a deep crimson circumferential zone, and yellow in the throat.—*C. H.*

Cattleya 'René Andre.' By Ed. André (*Rev. Hort.* pp. 332, 333; July 1901).—Coloured plate and woodcut. Natural hybrid from

Brazil, believed to be *C. Mossiæ* × *C. speciosissima*. Very handsome form.—*C. T. D.*

Caucasus, Notes from the. By A. K. Andersson (*Gard. Chron.* No. 754, p. 361 ; 8/6/1901, and following Nos.).—An account is given of the climate, rainfall, vegetation, and general features of this very interesting district, which are very varied, as can be easily understood when it is realised that in some parts there are snow-clad mountains, and in others valleys where there is a sub-tropical flora, where Oranges, Pomegranates, and Figs can be grown.—*G. S. S.*

Celery, Cooking of. By H. Roberts (*Gard. Mag.* 2,485, p. 375 ; 15/6/1901).—Various recipes for cooking Celery are given, and are worthy the notice of those who wish to use this vegetable in other than the usual raw state.—*W. G.*

Century of Orchid Growing (*Orch. Rev.* vol. ix. p. 2, Jan. 1901).—A most interesting article on the various developments of Orchid culture during the past century.—*H. J. C.*

Cerasus pendula rosea. By S. Mottet (*Rev. Hort.* pp. 352–354 ; August 1901).—Two woodcuts representing a very handsome flat-topped weeping floriferous tree ; flowers deep rose, in long pendulous racemes. *C. T. D.*

Chamædorea species as Window Plants (*Gartenflora*, p. 285 ; 1/6/1901).—The suitability of these Palms as plants for rooms is briefly recorded.—*J. P.*

Chelonopsis moschata, Miq. By Sir J. D. Hooker (*Bot. Mag.* tab. 7783).—Nat. ord. *Labiatæ* ; tribe *Stachydeæ*. Native of Japan and China. It is allied to *Melittis Melissophyllum* (the Bastard Balm of the British Flora). It has a similar few-flowered lax cyme, the flowers being ·2 inches long, of a pale rose colour. It flowered at Kew, 1900.—*G. H.*

Cherry-tree Disease. By Aderhold (*Zeit. f. Pflanz.* bd. xi., ht. 2 and 3, p. 65, plate ii. ; June 1901). Description of a new fungus (*Fusarium*) which attacks the flower and young fruit ; it is most likely to occur in a moist season.—*W. G. S.*

China Aster 'Plume d'Autruche.' By Ph. L. de Vilmorin (*Rev. Hort.* pp. 260, 261 ; June 1901).—Two illustrations (one coloured) of a very beautiful lax-petalled strain, very distinct from the usual stiff-rayed forms, and resembling some of the finer Chrysanthemums. Very handsome. Cultivation same as usual.—*C. T. D.*

Chrysanthemum Rust. (*U.S.A. Exp. St. Hatch*, Report 10, 1898).—First occurrence of this disease was during 1896. Attributed to *Puccinia Tanaceti.* At the time of this report little was known of its ravages, or any effort to check it.—*M. C. C.*

Chrysanthemum Mildew. By M. Chifflot (*Gard. Chron.* No. 753, p. 351; 1/6/1901).—The winter, spring, and summer treatment of plants attacked by this fungus is given, and the most appropriate remedies.
G. S. S.

Cider, Normandy. Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 81-84, June 1901).—Report of the Foreign Office on the French cider industry. The production was greater than the last decennial average by over 300 million gallons. *R. N.*

Citrus sinensis, variegated. By A. v. d. H. (*Rev. Hort. Belge*, t. xxvii. p. 193, September 1901. Col. pl.).—A variety with gold-edged leaves and orange fruit $1\frac{1}{4}$ to 2 inches diameter.—*G. H.*

Clematis. By G. Ugolini (*Bull. R. Soc. Tosc. Ort.* 6, June 1901, p. 177).—An interesting description of nineteen species which are hardy in Italy.—*W. C. W.*

Clianthus Dampieri grafted on Colutea arborescens (*Gard. Chron.* No. 757, fig. 157; 29/6/1901.)—M. Marc Micheli has successfully made this graft with the result that the *Clianthus* is rendered perennial, and flowers freely in a warm greenhouse.—*G. S. S.*

Clianthus Dampieri, on the Grafting of. By S. Mottet (*Rev. Hort.* p. 256; June 1901). With illustration of same grafted on *Colutea arborescens*, which is recommended as preferable to *C. frutescens* as stock.
C. T. D.

Cocoa, Fungoid Diseases of. By Mr. Alb. Howard, Mycologist, Imp. Dep. of Agr. W.I. (*Bull. Bot. Dep. Jam.* vol. viii. p. 113). Treats of "Brown-rot" of the Cocoa pod, and the damage done by it; also "Root" disease. In the conclusion remedies are given.—*G. H.*

Coco-nuts, imperfect. By Dr. Macdougal, New York Bot. Gard. (*Bull. Bot. Dep. Jam.* vol. viii. p. 104).—Reports on specimens from the Bot. Gard. Jam. Deficiency in weight was upwards of 300 grams. They contained no seed, the hollow being almost entirely overgrown with woody fibres of the husk, only a narrow cavity being left. In this were three centres about which a small quantity of shell substance had begun to form; other details are given. The cause appears to be imperfect fertilisation, which had stimulated the ovary without impregnating the ovules. *G. H.*

Cola, Notiz über. By A. Tschirch (*Flora*, vol. lxxxviii. Pt. 2, pp. 242-4; four figures; March 1901).—A discussion with K. Schumann on the botanical sources of the Cola Nut. The plant at Buitenzorg is not *Cola vera*, K. Schum., but *C. acuminata*, Schott and Endl., or closely allied thereto.—*M. H.*

Coleus somalensis. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 265; 8/1901).—Description of a new species from Somaliland nearest to *C. vestitus*.—*G. S. B.*

Coleus thyrsoideus. By Ch. Pynaert (*Rev. Hort. Belge*, t. xxvii. p. 205, September 1901. Col. pl.).—Nat. ord. *Labiatæ*. The species is remarkable for the large dark-blue flowers, which continue without intermission for three months. It is a native of Nyassa, Central Africa. *G. H.*

Colorado, Notes, &c., on Plants of. By Aven Nelson (*Bot. Gaz.* vol. xxxi. p. 394, No. 6). – *Zygadenus coloradoensis*, Rydb.; *Cheiranthus*, sp.; *Clematis Scottii*, Porter; *Saxifraga rhomboidea austrina*, n. var.; *Parosela Porteri*, n. sp.; *Petalostemon pubescens*, n. sp.; *Gentiana Moseleyi*, n. sp.; *Polemonium Archibaldæ*, n. sp.; *Monarda Nuttallii*, n. sp.; *M. Ramaleyi*, n. sp.; *Oonopsis monocephala*, n. sp.; *Eupatorium atromontanum*, n. sp.; *Coleosanthus congestus*, n. sp.; *Kuhnia Fitzpatricki*, n. sp.; *K. Gooddingii*, n. sp.; *K. Hitchcocki*, n. sp.; *K. reticulata*, n. sp.; *Lacinaria alata*, n. sp.; *L. ligulistylis*, n. sp.; four new species of *Arnica*. *G. H.*

Colorado Potato Beetle. By F. Martin Duncan (*Gard. Mag.* 2,500, p. 626; 28/9 1901). – An interesting note, accompanied by an illustration of this beetle, which recently reappeared in England after an absence of some years. The appearance and habits of this insect cannot be too well known among those who are engaged in the imported Potato trade. In No. 2,497, p. 576, a supplementary account is given of the Colorado beetle, together with eight illustrations of beetles of similar appearance, which may be mistaken for the true Potato Beetle.—*H. G.*

Colour change in Spring Plants. ("Ueber den Polychroismus der Fruhlingspflanzen"). Von W. Taliew (*Beih. Bot. Cent.* bd. x. ht. 8, pp. 562 564).—*Pulmonaria officinalis*, L., and *Orobus vernus*, L., change from a more or less red colour to blue in the oldest condition. *Anemone ranunculoides*, L., is yellow in Europe, but in the Urals its varieties show an extraordinary number of colours blue, pale blue or white, pink to white, yellow to pale yellow and white, or even occasionally mixed colours; sometimes the upper side of the petals is red and the lower yellow. *Anemone patens* shows similar variation. *Iris pumila*, in Southern Russia, varies from violet-red, dark blue, to yellow or almost white; *Tulipa Gesneriana*, L., from deep-red to yellow and white. *Myosotis amœna*, *Primula acaulis*, *Matthiola odoratissima*, and *Crocus variegatus* show similar variations in Russia.—*G. F. S.-E.*

Commercial Plants, their Introduction, Selection, and Improvement. By Jared G. Smith (*U.S.A. Dep. Agr.* 1900, p. 181).—The advantages are shown which have been obtained by the introduction and selection from various sources of different strains of the same commercial plants.—*C. W. D.*

Congo, Ornamental Plants of the. By L. Gentil (*Rev. Hort. Belge*, t. xxvii. p. 147, No. 7, July 1901).—After comparing the forest flora with that of Brazil, which has generally finer foliage and flowers, the author alludes to several plants from the Congo of horticultural value, as *Platycerium angolense*, *Crinum Laurentii*, *Cyathea angolensis*, *Rhipsalis*

cassytha africana, *Encephalartos Lemarinellii*, *Eulophia Lubersii*, *Coffea Laurentii* and several others.—*G. H.*

Congress held in Paris, 1901 (*Jour. Soc. Nat. Hort. Fr.* p. 726).—Amongst the subjects discussed, the most interesting was in the class of "Monographs on a single Genus of Plants," a most able paper on Lilacs and Ligustrinas, by M. L. Henri, professor at the National School of Horticulture, Versailles, and Chef des cultures at the Jardin des Plantes, Paris. It gives a most careful synopsis of all the known species in cultivation, or known only from herbarium specimens, and a valuable record of M. Lemoine's and others' labours in the production of the new double Lilacs and the improvement in colour of the singles. His own work amongst them (*Breitschneideri*) is also modestly recorded. A capital monograph.—*G. P.*

Convention of Agricultural Colleges and Experiment Stations, 1900 (*U.S.A. Dep. Agr.* No. 99).—Contains reports of the proceedings of the Fourteenth Annual Convention, amongst which are:—"Plant Physiology in relation to Horticulture and Agriculture," "Laboratory Work in Horticulture," "The Educational Status of Horticulture," "The Function of the Station Botanist," "Progress of Variety Testing in Experiment Station Work," "Seed and Plant Introduction," "Grass and Forage Plants Investigations," &c.—*M. C. C.*

Cornu, Professor Maxime. By M. P. Hariot (*Jour. Soc. Nat. Hort. Fr.* p. 421).—A brief appreciative memoir of M. Cornu, since 1884 in the chair of Culture at the National Garden of the Jardin des Plantes, Paris. His fame as a botanist was acquired in his work amongst cryptogams, but he did good service in reorganising the gardens, inside and out, and in fostering the distribution to French colonies of economic plants. He seems to have made successful efforts to bring into closer relations the National establishment and the Horticultural Society of France, as well as lending aid to commercial horticulture in that country.
G. P.

Cotton Crop of 1899-1900, The. By James B. Watkins (*U.S.A. Dep. Agr. Miscl. Ser., Bull.* No. 19).—A statistical retrospect of the Cotton crop grown in the United States for the commercial year ending August 31, 1900. This includes a detailed statement of movement of bales in individual States, and a comparison with the crop of preceding year.
E. F. H.

Couch-grass, Bindweed, Corn Thistle, Destruction of. By H. Dauthenay (*Bull. R. Soc. Tosc. Ort.* 7, p. 218; July 1901).—Account of the mode of growth of these pernicious weeds, the inadequate methods frequently employed for uprooting them, and the surest and most effective means for disposing of each of them.—*W. C. W.*

Cratægus Koralkowii, pinnatifida and pentagyna. By L. Henry (*Rev. Hort.* pp. 308-311; July 1901; with coloured plate and two woodcuts).—Observations on specific differences, full descriptions of

each, and illustrations of two distinct forms of berry borne by *C. pinnatifida*.—*C. T. D.*

Creat (*Andrographis paniculata*). By Dr. Watt (*Bull. Bot. Dep. Jam.* Vol. VIII., p. 85).- Nat. ord. *Acanthaceæ*. A native of India and Ceylon. A bitter shrub used as a common household medicine in Bengal for children. A common weed introduced in Jamaica.—*G. H.*

Crinum rhodanthum, Baker. By Sir J. D. Hooker (*Bot. Mag.* tab. 7777 8).--Nat. ord. *Amaryllideæ*; tribe *Amarylleæ*. This plant is a native of Ngami Land, on Mt. Kwebe, east of the lake. It flowered at Kew 1899. The bulb is 4 inches diam. Leaves 12-15 inches. Umbels of many pale red flowers.—*G. H.*

Crotons of the United States. By A. M. Ferguson (*Rep. Miss. Bot. Gard.* vol. xii. p. 33, 1901). Plates 4 31.—Full technical revision of the genus *Croton*, with key to, and descriptions of, the twenty-six United States species and their chief varieties, all of which are figured with details of flower, fruit, seed, &c.—*G. S. B.*

Cucumbers, Forcing of. By Numa Schneider (*Rev. Hort.* pp. 313, 314, 338 341; July 1901).—With four woodcuts of forcing houses. *C. T. D.*

Cucumber-growing at Znaim, in Bohemia. By M. J. Zawodny (*Jour. Soc. Nat. Hort. Fr.* p. 526).—An interesting description, with illustrations, of what is now the large industry of Cucumber growing in Moravia, more especially when contrasted with the considerable industry in indoor Cucumber culture in Hertfordshire and elsewhere in England. The produce was in 1895 100,000 quintaux. The fruit is exported, fresh and salted, all over the Austrian and German Empires, Russia, France, and America. Full details are given of methods of packing, prices, &c.--*G. P.*

Cucumber Wilt, Bacterial (*U.S.A. Exp. Stn. Hatch, Report* 12, 1900-1).--The bacteria which cause the trouble develop mostly in the ducts of the stem and leaf-petioles, multiplying rapidly and causing a stoppage of the flow of sap, and hence a wilting of the leaves. The organisms can be seen oozing in little drops from cut ends of affected parts.—*M. C. C.*

Cuttings, Woody, Roses, &c. By Georges Bellair (*Rev. Hort.* pp. 280, 281; June 1901; three woodcuts).—An interesting note on cuttings obtained after formation of a thick cortical callus, induced by previous bark-ringing.—*C. T. D.*

Cyanotis hirsuta, Fisch. By Sir J. D. Hooker (*Bot. Mag.* tab. 7785). —Nat. ord. *Commelinaceæ*; tribe *Tradescantieæ*. Native of Abyssinia. First discovered about 1840 by Schimper. It has edible tuberous roots, called "Burko" by the natives. It flowers almost throughout the year in a greenhouse. Leaves, 2 to 12 inches long, and a quarter to three-fourths of

an inch wide; flowers three-quarters of an inch across, rose-coloured, with purple hairs on the filaments.—*G. H.*

Cyclamen pseudibericum nov. sp. Hildebrand (*Beih. Bot. Cent.* bd. x. ht. 8, p. 522).—Herr Friedrich Hildebrand describes a new species, which he calls one of the prettiest and most sweet-scented of Cyclamen in cultivation. It was received from Heer C. G. Van Tubergen, jun., in Haarlem. Diagnosis: Corm nearly spherical; the upper surface covered by a layer of cork, and the roots scattered on the lower half of the corm. Leaves obcordate, rounded at the apex and bases; margin with irregular rounded teeth; upper surface dark green with a silvery reflection, and lower surface dark violet. Flowers in spring. Sepals lanceolate, slightly undulate at margin. Corolla tube elongate, ovate, somewhat contracted at the throat; petals not auricled at the base, elongate ovate, violet red, pure white at the base with a dark violet spot, covered above with globular glandular hairs. Style projecting slightly out of the corolla throat. Native country unknown.—*G. F. S.-E.*

Cydonia sinensis. By Dr. Alfred Burgerstein (*Wien. Ill. Gart. Zeit.* p. 207).—Accompanying the figure is a synopsis of the Cydonias, but the article is mainly devoted to the Japan Quinces, the author enumerating five species, viz. *vulgaris*, *japonica*, *Maulei*, *Sargenti*, and the Chinese—*sinensis*. The plant, but recently reintroduced into England (it is growing in the Cambridge Botanic Garden), was figured from Whitley's (later Osborn's) Fulham Nurseries in *Bot. Rev.* vol. ii. p. 905.—*G. P.*

Cyperaceæ Chilenses. By C. B. Clarke (*Engl. Bot. Jahrb.* xxx. *Beibl.* 68, pp. 1–44; 2/7/1901).—A systematic account of the *Cyperaceæ* of Chili, excepting the Carices. Includes a useful clavis of genera, and also one for the species of each genus.—*A. B. R.*

Cypripedium 'James K. Polk' (*Rep. Miss. Bot. Gard.* vol. xi.; 1900; plate).—A hybrid between *C. nitens magnificum* and *C. Chamberlainianum*, raised by Henry Clinkaberry, gardener to C. S. Roebling, of Trenton, N.J., and presented by him to the Missouri Garden.—*G. S. B.*

Cypripedium (Paphiopedilum) × Baron Schröder (*Orch. Rev.* p. 81, fig., March 1901).—A good representation, and particulars, of this, one of the finest of the hybrids of the *C. Fairrieanum* section.

H. J. C.

Cypripedium (Paphiopedilum) × Rolfei (*Orch. Rev.* p. 305, fig., Oct. 1901).—A good illustration of the hybrid recently exhibited before the Orchid Committee at the R.H.S., and descriptive particulars.

H. J. C.

Cypripedium spectabile, Sw., **Eine Blüthe v., mit Rückschlagserscheinungen.** By A. Osterwalder (*Flora*, vol. lxxxviii. Pt. 2, pp. 244–7; four figures; March 1901).—In the interesting monstrous form described the paired sepals are free, the odd petal is small, and not labelliform or slipper-shaped. Two antisepalous leaf-like staminodes are present, but not the unpaired one usually found. All three stamens of the inner set are present and fertile.—*M. H.*

Cyrtostachys Renda, Blume. **var. Duvivierianum,** and col. pl. By Ch. Pynaert (*Rev. Hort. Belge*, t. xxvii. p. 145, No. 7, July 1901).—This genus contains one other species of Malay Arch., viz. *C. ferox*, Lind. They have pinnate leaves, and the species described is remarkable for its bright crimson petioles.—*G. H.*

Cytisus (Brooms). By W. Goldring (*Gard. Mag.* 2,497, p. 579; 7/9/01).—A descriptive account of all the finest species and varieties of *Cytisus* in cultivation, with hints on their position in gardens and their culture. Illustrations are given of *C. kewensis*, *C. præcox*, and *C. scoparius sulphureus*.—*W. G.*

Daphne Verloti. By S. Mottet (*Rev. Hort.* pp. 304, 305; July 1901; two woodcuts).—Highly recommended as a dwarf spring-flowering hardy shrub.—*C. T. D.*

Darwin Tulpen. By E. Krelage (*Die Gart.* p. 2–4; 5/10/1901).—List of varieties, cultural notes, and uses, also coloured plate of Darwin Tulips.—*G. R.*

Dates: the Culture of the Date Palm. By Walter T. Swingle (*U.S.A. Dep. Agr.* 1900, p. 453).—Statistics concerning the cultivation are given. An Arab maxim says: "The Date Palm must have her feet in running water and her head in a burning sky." The conditions are discussed under which the tree may be grown and fruited successfully. They may be found in some parts of Arizona and New Mexico.—*C. W. D.*

Delphinium sinense. (*Rev. Hort.* p. 378; August 1901).—Note on a large-flowered lilac variety and a spurless form resembling a double Cineraria, both raised by E. Gauguin, horticulturist, at Orleans.—*C. T. D.*

Depth of Cultivation in relation to Yield of Wheat. By M. N. Passerini (*Ann. Ag.* p. 298; June 25, 1901).—The best crop resulted from land dug to a depth of half a metre.—*C. H. H.*

Dianthus pelviformis. By S. Arnott (*Gard. Chron.* No. 762, p. 97, fig. 31, 3/8/1901).—This species was obtained from Mr. Henkel of Darmstadt. It is suitable for growing on rockwork. It bears a compact head of red blossoms on a long stalk.—*G. S. S.*

Digitalis, certain hereditary Anomalies in. By A. Gallardo (*Rev. gén. Bot.* xiii. p. 163, 1901; figs. 39, 40, 41).—The author describes abnormalities appearing in the flowers and inflorescences of *Digitalis purpurea*, L., which he observed in a garden near Buenos Ayres. A varying percentage of the abnormalities came true from seed, but the amount appeared to be related to the condition under which the new generations were raised. The paper is illustrated by curves, which are based on the numbers of stamens, and frequency of the occurrence of such numbers as a means of arriving at a measurable relation between the various forms obtained.—*J. B. F.*

Disa Hybrids (*Orch. Rev.* p. 278, Sept. 1901).—The numerous hybrid Disas, with their parentage and other particulars, are gone into at length. *H. J. C.*

Diseæ, Monograph of the. By R. Schlechter (*Engl. Bot. Jahrb.* xxxi. pp. 184-288, tt. i.-vi.; 16/8/1901).—A systematic revision of the genera *Satyrium, Pachites, Disa, Schizodium* and *Brownleea*, which the author regards as comprising the group *Diseæ*.—*A. B. R.*

Disease, The So-called "Little Peach" (*Agr. Gaz. N.S W.* vol. xii. Part 6, p. 715).—During the last two seasons much trouble has been caused in several Peach-growing districts of the United States by a peculiar disease in Peaches called, in the absence of any knowledge as to its cause, "Little Peach." The fruit upon affected trees does not attain a size greater than a pigeon's egg, and, as a rule, the tree dies within the season. Professor Waite, as well as Professor Stewart, of the New York State Agricultural Experiment Station, has been investigating the disease, but has not yet been able to determine the cause of it. It is said to spread rather rapidly. Up to the present, the only remedy that can be recommended is to root up and burn the trees as early as possible after the disease is first discovered in them.—*A. W. S.*

Dragon-tree of Teneriffe. By John Low, M.D., F.L.S. (*Gard.* p. 67, 27/7/1901; fig.; con. p. 79, 3/8/1901).—Giving interesting particulars as to age and dimensions of this wonderful tree. Continued p. 78, 3/9/1901.—*H. J. C.*

Droseras. By R. L. Harrow (*Gard. Mag.* 2,495, p. 548; 24/8/1901).—The species of *Drosera* (Sundew) in cultivation are described by the writer, who adds good practical notes on their cultivation. An illustration is given of *D. ramentacea*. *W. G.*

Education in Agriculture and Horticulture. By Rev. W. Simms (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 1, p. 77).—A paper of the utmost value and suggestiveness, which, with the discussion which followed it, should be read by everyone interested in the introduction of such teaching into our English primary and secondary schools. It is immediately followed by papers by Prof. d'Albuquerque and M. W. Fawcett on science teaching in colleges and in schools, which are equally valuable and suggestive. See also vol. i. No. 3 and vol ii. No. 1, p. 56.—*W. W.*

Elm-leaf Beetle. By C. Clarke, City Forester, Northampton, Mass. (*Amer. Gard.* xii. p. 568, 17/8/1901).—The result of five years' experience with this pest shows that it can be exterminated by spraying the foliage, as soon as the leaves are formed in the spring, with arsenate of lead. Old trees should be sprayed twice, once in the spring, and again in the early summer. The trees should also be sprayed two years in succession to gain the best results.—*C. C. H.*

Elm-leaf Beetle, The. By J. M. Southwick (*U.S.A. St. Bd. Agr. Rhode Is. Bull.* 12, July 1901, pp. 1-12, pl.).—A description and plate of

this insect in its various states are given, and a full account of its life-history, and the injuries done to Elm-trees by its grubs. It is known to entomologists as *Galerucella luteola*, and it is fortunately unknown in this country.—*G. S. S.*

Elliottia racemosa (*Amer. Gard.* xxii. pp. 631; 14/9/1901).—A note on the recent rediscovery of this genus of a single species by Mr. R. M. Harper in Georgia, U.S.A. This plant belongs to the Heath family, and is closely related to the more northern genus *Ledum* (Labrador Tea). It is a branching shrub, with deep-green leaves and showy white flowers.

It was originally discovered in Georgia early last century, but was thought to be extinct in a wild state, until recently discovered again. (For further details see Dr. Small in Journal of New York Botanic Gardens, August 1901). According to Dr. Small, the fruit of this genus is still unknown to science.

There are three plants of *Elliottia* in cultivation with Mr. P. J. Berckmans of Augusta, Ga., and possibly one at Kew.—*C. C. H.*

Epidendrum osmanthum, Rodrig. By Sir J. D. Hooker (*Bot. Mag.* tab. 7792).—Nat. ord. *Orchideæ*; tribe *Epidendreæ*. Native of the forests of Brazil. It was introduced by Sander, 1899. Flowered at Kew 1900. The flowers are odoriferous and aromatic, lasting about two months. They are about 2 inches long; sepals and petals yellow streaked with red, lip being white suffused with red.—*G. H.*

Eremurus. By M. S. Mottet (*Jour. Soc. Nat. Hort. Fr.* p. 804).—A capital botanical-horticultural monograph on *Eremurus*. The author wisely adopts this title, as no doubt amongst many of the so-called species in Section 2, *Henningia*, are some which are only varieties (possibly hybridised) of *E. robustus*. It is the best record of the genus we have seen.
G. P.

Erigeron Coulteri. By S. Arnott (*Gard. Chron.* No. 762, p. 99, fig. 32, 3/8/1901).—A recent introduction from Colorado, and said to be "one of the most promising hardy flowers introduced into cultivation this season." It has soft white flowers, and is of a close tufted habit of growth.—*G. S. S.*

Eriocaulon decangulare, L. By Theo. Holm (*Bot. Gaz.* vol. xxxi. p. 17; No. 1.—An anatomical study (with 5 figs.). This deals with the structure of root, rhizome, scape, and prophyllum (bract).—*G. H.*

Erythronium, A Contribution to the Life-history of. By J. H. Schaffner (*Bot. Gaz.* vol. xxxi. p. 369; No. 6; 6 plates).—Describes karyokinesis in the bulb; development of the megasporangium &c.; and the development of the embryo.—*G. H.*

Ether, Forcing of Plants by means of. By H. Dauthenay (*Rev. Hort.* pp. 350, 351; Aug. 1901).—Abstract of results obtained by Prof.

Johannsen, of Copenhagen, as recorded in the "Indépendance Belge":—The plants concerned, principally Lilacs, are subjected to the vapour of sulphuric ether in the early autumn, the result being the killing of the existing foliage, followed by a rapid development, under forcing conditions, of the next season's flower-buds. Directions are given for application of the ether, and remarks made as to the adaptation of the processes to various flowering plants other than Lilacs.—*C. T. D.*

Eupatorium petiolare. By W. E. Gumbleton (*Gard. Chron.* No. 755, p. 379, fig. 142; 15/6 1901).—A free-blooming, sweet-scented greenhouse plant, with a delicate odour of vanilla; flowers early in the season, and is on that account a valuable acquisition.—*G. S. S.*

Euphorbia. By J. B. S. Norton (*Rep. Miss. Bot. Gard.* vol. xi., p. 85; 1900; plates 11–52).- Revision of the forty species of the section *Tithymalus*, occurring in America north of Mexico, with analytical key, diagram of relationship, full synonymy, figures giving details of flowers and seeds, description of several new varieties and of one new species, *E. alta* = *E. dictyosperma* Engelm., non Fischer and Meyer.—*G. S. B.*

Feijoa Selloviana, Berg. By Prof. R. Pirotta (*Bull. R. Soc. Tosc. Ort.* 6, June 1901, p. 174). - Genus founded by Berg in 1858 for plants formerly described by him as *Orthostemon*. It is hardy in Italy. One of the few ornithophilous plants, being fertilised by species of *Thamnophilus*, according to Fritz Muller. The petals, at first spread out, become at length rolled into a tube and have then a sweet taste.
W. C. W.

Ferns, truncate. By C. T. Druery (*Gard. Chron.* No. 753, p. 354; 1/6/1901).—Attention is called to certain Ferns which at times produce truncated fronds, and the possibility is suggested of this being the result of "long-continued truncation, whether by hedgers, sheep, or insects, including variation to fit, which is, however, pure hypothesis, and only advanced as such."— *G. S. S.*

Ferns, Observations on the Anatomy of Solenostelic. By D. T. Gwynne-Vaughan, M.A. (*Ann. Bot.* vol. xv. No. lvii. p. 71).—Solenostelic is a convenient word to indicate what De Bary called the "closed tubular bundle." *Loxoma* is the genus here studied, and it is found to be typical of solenostelic Ferns. Horticulturists and botanists are familiar with the broken wood ring of most Ferns, but in Ferns of this more exceptional structure the vascular tissue is arranged in a single hollow cylinder. *Loxoma*, unfortunately, is not in cultivation. Mr. Gwynne-Vaughan points out the similarity of the anatomy of solenostelic Ferns and that of *Marsilea*.—*R. I. L.*

Figs. The Cultivation of the Smyrna Fig in the United States. By L. O. Howard (*U.S.A. Dep. Agr.* 1900, p. 79).—An interesting account of the introduction of the insects which fertilise the Figs, and the successful growth of Figs in California. Perhaps similar success might be attained in some of the Colonies of Great Britain.—*C. W. D.*

Finger and Toe, Prevention of. Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 103, 104, June 1901).—It is suggested that land affected by this disease should be dressed with from two to four tons per acre of common lime, according to the soil and the virulence of the attack, as soon as possible after the diseased crop has been removed.—*R. N.*

Flea-beetles. By Clarence M. Weed (*U.S.A. Exp. Stn. New Hamp.* No. 29; 6/1895; 6 figs.).—Recommends dusting attacked crops with plaster, air-slaked lime, soot, or tobacco powder when plants are wet with dew, but especially spraying with Bordeaux mixture *plus* Paris green in the proportion of 4 oz. of the latter to 50 gallons of the former.
F. J. C.

Flora of Africa, Contribution to the. XXII. By A. Engler. (*Engl. Bot. Jahrb.* xxx. pp. 239-288, tt. iv.-viii.; 2/7/1901).—A systematic account of the plants collected by W. Goetze at Lakes Rukwa and Nyassa, and in the intervening mountainous country. Includes the Cryptogams and the Monocotyledonous division of seed-plants, the different families elaborated by specialists.—*A. B. R.*

Flora of Mattogrosso, Contribution to the. By R. Pilger *Engl. Bot. Jahrb.* xxx. pp. 127 238; 2/7/1901).—The author, who accompanied Dr. Hermann Meyer's expedition to Central Brazil in 1899, spent several months, from March to October, in a botanical exploration of the valleys of the Cuyaba and Paranatinga Rivers and the watersheds between them. The present paper comprises a systematic enumeration of the seed-plants which he collected, with descriptions of new forms, and a useful account of the plant-geography of the district. In the systematic work Mr. Pilger has had the assistance of specialists in several important families.—*A. B. R.*

Foot-rot, Collar-rot, or Mal di Gomma (*Bull. Bot. Dep. Jam.* vol. viii. p. 107).—The English names allude to the place where the tree is attacked; the Italian, to the secretion of gum. The bark decays, gumming follows; when it has girdled the tree, death ensues. It is most common with improper drainage, crowding, continuous use of organic fertilisers or of irrigation, keeping the soil water-soaked. It appears to be contagious. The following remedy is suggested for ants attacking the bark of trees at the foot and for the disease: 2 lb. clay dissolved, 2 lb. flour of brimstone, some soft soap, and two spoonfuls of kerosene oil, applied with a brush.—*G. H.*

Forest Working Plan for Township 40, A. By R. S. Hosmer and E. S. Bruce (*U.S.A. Dep. Agr., Div. For., Bull.* No. 30).—This plan is drawn up as a guide to the practical management and profitable use of the above portion of "New York State Forest Preserve." It is preceded by "A Discussion on Conservative Lumbering and the Water Supply," by F. H. Newell.—*E. F. H.*

Fruit and Vegetable Imports (*Gard. Mag.* 2,498, p. 589; 14/9/1901).—An abstract account of the quantities and value of imports

of fruits and vegetables into Great Britain and Ireland from various countries. It is satisfactory to note that the British growers of soft fruits, such as Strawberries, Gooseberries, Cherries, and Plums, hold their own against the foreign producer. Fruits such as Bananas show a large increase in the imports since the Jamaica trade in that fruit has been so active.—*W. G.*

Fruits, hardy, Selections of. By T. Coomber (*Gard. Mag.* 2,499, p. 610; 21/9/1901).—An excellent selection of Apples, Pears, Plums, Nectarines, Cherries, and Apricots, compiled with a view of affording a choice of varieties that give a continuous supply of fruit during their respective seasons.—*W. G.*

Fruits, small, Industry (*Gard. Mag.* 2499, p. 605; 21/9/1901).—An abstract from the official returns of the acreage under hardy fruits in Great Britain. The returns show that the area devoted to the cultivation of small fruits in Great Britain has more than doubled in the past thirteen years. The returns of fruit-growing areas are given for the past twelve years.—*W. G.*

Fruits, Tropical. John R. Jackson, Museums, Kew (*Agr. Jour. Cape G.H.* vol. xix. No. 3, pp. 180-185, Aug. 1, 1901).—The author refers to the exhibition of fruits, chiefly from the West Indies and Australasian Colonies, at the Indian Exhibition held at South Kensington in 1886, when it was hoped that such fruits would in time become regular articles of commerce. "We cannot say that the hopes and prophecies of 1886 have been realised in 1900." But among those fruits which appear at more or less regular intervals are mentioned the following:—

Shaddock (*Citrus decumana*), a native of the Malayan and Polynesian islands, and under cultivation in India; Kumquat (*Citrus japonica*), native of Japan and China; Cherimoyer (*Anona Cherimolia*), from Peru, New Grenada, Venezuela, and Brazil; Sweet Sop (*A. squamosa*), native of the Malay Islands, and cultivated both in the East and West Indies; Sour Sop (*A. muricata*), and the Custard-apple (*A. reticulata*); the Mango (*Mangifera indica*); Avocado Pear (*Persea gratissima*); the Lychee or Litchee (*Nephelium Litchi*), a native of China and the East Indian Islands. The fruits of the following plants are also discussed:—*Diospyrus virginiana*; the Chinese Date-plum (*D. Kaki*); Star Apple (*Chrysophyllum cainito*); Marmalade Plum (*Lucuma mammosa*); Naseberry or Sapodilla Plum (*Achras sapota*); the fruit of the South African Kei Apple (*Aberia caffra*); the Natal Plum (*Carissa grandiflora*); and the Cho-Cho (*Sechium edule*).—*R. N.*

Fruit-trees, Nettings for. By the Editor (*Agr. Jour. Cape G.H.* vol. xix. No. 2, p. 117, July 1901).—The Board of Horticulture (Western Province) is importing new bird and mosquito nettings for the protection of fruit, which will be offered at the cost price of 15*s.* per piece, 180 feet long and 18 feet wide. "It will be made of very light twine, and will have meshes about five-eighths of an inch square." This has been devised to supersede the ordinary herring netting imported from England.—*R. N.*

Fruit-trees, Pollination of. By J. J. Willis (*Gard. Mag.* 2,503, p. 674; 19/10/1901).—The writer describes the various causes of the failure in the setting of hardy fruit-blossoms. Some of the causes of sterility may be remedied by cultivation, but where atmospheric conditions are the cause there is no remedy in orchard culture. The article should be perused by those engaged or interested in fruit-culture.—*W. G.*

Fruit-trees, Proposed Register of. By P. J. Cillie (*Agr. Jour. Cape G.H.* vol. xviii. No. 13, pp. 876–879, June 1901).—The author gives statistics "based on practical experience, showing what varieties of fruit-trees are or are not suited to the various fruit-growing districts of the Colony."—*R. N.*

Fruit-tree Tortrix (*Penthina variegana*, Hübn.) (*Gard. Chron.* No. 753, p. 342; fig. 126; 1/6/1891).—Only lately recorded in this country as a pest on various fruit-trees. The life-history and a description of the insect are given. The caterpillars feed on the upper surfaces of the leaves, leaving a network of veins. Spraying with "Paris green" is recommended as the best remedy.—*G. S. S.*

Fungi, Berkeley's Types of, redescribed. By G. Massee (*Jour. Linn. Soc.* vol. xxxv. pp. 90–119, pl. 4 and 5).—This paper is a continuation of the work commenced in vol. xxxv. p. 362, and includes the species of *Discomycetes* and *Hysteriaceæ*, of which type specimens exist at present in the Kew Herbarium.—*G. S. S.*

Fungi, Germination of Spores of. By B. M. Duggar (*Bot. Gaz.* vol. xxxi. p. 38; No. 1).—A physiological study. Treats of the percentage of germination; the influence of certain physical stimuli; the effects of temperature and oxygen supply; the inhibition of germination in nutrient solutions; the resting spores and drying-out of spores; submergence of spores; some peculiarities of germination; dilution of food-materials &c.—*G. H.*

Fungi, Mexican. By E. W. D. Holway (*Bot. Gaz.* vol. xxxi. p. 326, No. 5).—Seven species of *Uromyces*, eighteen of *Puccinia*, one *Uredo*, and one *Ravenelia*, one *Endophyllum*, one *Stichospora*, and three *Coleosporium* are described.—*G. H.*

Fungi, Saprophytic, and Salts of Nitrogen. By Miss M. H. Smith (*Bot. Gaz.* vol. xxxi. p. 126; No. 2).—Proved by experimental cultures that such fungi as *Aspergillus flavus* and *Botrytis vulgaris* flourished when supplied with either potassium nitrite or nitrate; the former fungus bore well-formed fruit.—*G. H.*

Fungicides. Prize for Copper. Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 99, 100, June 1901).—Notification regarding an international competition to be held under the auspices of the Federation of the Agricultural Unions of Italy for a prize of £40, which will be awarded to the person who discovers and makes public the best method for obtaining exact and constant results in the determination of the fineness of the flowers of sulphur, and of mixtures of sulphur, and copper sulphate. Competitors to send in their papers in a sealed envelope before March 1, 1902, addressed

to the head office of the Federation: Ufficio direttivo della Federazione italiana dei Consorzi agrari, Piacenza, Italy.—*R. N.*

Gaillardia, a New. By Ch. Grosdemange (*Rev. Hort.* pp. 337, 338; July 1901).—Large-flowered form, with orange-brown flowers; improvement on 'Toison d'Or'; very floriferous; good habit.—*C. T. D.*

Gaura Lindenheimeri. By H. Dauthenay (*Rev. Hort.* pp. 327–329; July 1901; three woodcuts).—Very floriferous. Highly recommended for bouquets and garden culture. Culture easy, but requires winter protection.—*C. T. D.*

Geniosporum fissum. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 263; 8/1901).—Description of a new species, forming the type of a new section, *Temnocalyx*, from British East Africa.—*G. S. B.*

Gentians. By E. Hampden (*Gard. Mag.* 2,494, p. 529; 17/8/1901).—A descriptive account of most of the species of Gentians in cultivation, with cultural notes.—*W. G.*

Geotropism of Stems. By E. B. Copeland (*Bot. Gaz.* vol. xxxi. p. 410; No. 6).—Experimental investigations of the geotropic curvature of radicles, the position of the points of bending &c. in dicotyledonous seeds, and in the cotyledons of monocotyledons.—*G. H.*

Geraniums, Picturesque Employment of. By Ed. André (*Rev. Hort.* p. 255; June 1901).—Interesting suggestions, with illustrations for outdoor decorations.—*C. T. D.*

Geranium Disease (*U.S.A. Exp. St. Hatch*, Reports 12–13, 1900–01).—Abundant on leaves of cultivated *Pelargonium*, and appears to be a dangerous enemy to the growth of the plant. It causes small yellow and dead spots on the leaves, so that they fall off and the plant becomes nearly denuded. The dead spots are full of bacteria and no other organisms, so that they seem to be the cause of the disease. To all appearance this seems to be a genuine bacterial disease.—*M. C. C.*

Ginkgo biloba, fertilisation of. By M. S. Ikeno (*Ann. Sc. Nat., Botan.* t. xiii. p. 305; plate 8; 1901).—This tree has become a centre of interest since the discovery of its motile ciliated antherozoids a few years ago. The present short paper adds a few new details. Two antherozoids leave the pollen-tube, and the fusion of one of them with the ovum is described and figured. The fate of the other antherozoid was followed as carefully as possible, but it disorganises: this is interesting because of recent observations of this body in higher plants. The process of fertilisation in *Ginkgo* agrees with that observed in *Cycas* and other Gymnosperms, except *Gnetaceæ*.—*W. G. S.*

Gipsy Moth, Extermination of. By Dr. Rörig (*Kais. Ges., Div. Biology*, bd. i., ht. 2, 1900.)—The caterpillars of this moth are so destructive on fruit and other trees that its combating receives special attention in Germany and the United States. The eggs, wrapped in a brownish cotton-wool covering, are laid in masses about the size of a grape or larger. To destroy these egg-masses Dr. Rörig describes a simple form of

distributer for paraffin oil by which a man on the ground can operate on trees up to ten feet.—*W. G. S.*

Gladiolus sulphureus, de Graaf. By Sir J. D. Hooker (*Bot. Mag.* tab. 7791).—Nat. ord. *Irideæ*; tribe *Ixieæ*. Native of the Transvaal. Flowers, 2½ inches long, primrose-yellow in colour.—*G. H.*

Gooseberry Mildew (*Microsphæria grossulariæ*). Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 1, 2, June 1901, with plate, figs. 1–3).—This fungus, which appears as a flowery substance on the leaves in spring, presenting minute black points later in the season, is briefly described, together with the allied American Gooseberry Mildew (*Sphærotheca Mors-uvæ*), which occurred in abundance in county Antrim, Ireland, in 1900. Illustrations of both species are given on an accompanying plate. Spraying with a solution of potassium sulphide, in the proportion of 1½ lb. of sulphide to 50 gallons of water, is recommended as the most effective remedy.

"Bordeaux mixture must not be used after the fruit is set, and is not under any circumstances as effective as the potassium sulphide solution."

Dead leaves and fruit should be collected and burnt.—*R. N.*

Gooseberry Saw-fly Caterpillar. By Alger Petts (*Gard. Mag.* 2,500, p. 280; 28/9 1901).—The writer explains the various remedies he has tried or heard of for the extermination of this pest, which all seem to be troublesome remedies, though worth adopting in bad cases.—*W. G.*

Grafting of Vines. By Augusto Ville (*Bull. R. Soc. Tosc. Ort.* 7, p. 195, July 1901).—"English Herbaceous Grafting," as the author terms it, was invented in 1897 by a vine-grower called Lafleur, and is usually named after him. The graft is always inserted on the subaërial part of the plant. It must take place from the end of May to the middle of July, or from a fortnight before the flowering period until three or four weeks after the same. The latter period is more favourable, as the buds are then better set. It is advisable to insert several grafts on the same stock in case of failures, and on branches which have been lopped before the vegetative period set in. The grafts should be chosen from shoots of the year, and are usually cut off above the first or second leaf—above the uppermost cluster of Grapes. Buds must be taken from those plants which bear most fruit. If the section of the wedge-shaped graft presents a greyish appearance, this is a sign of lignification and of the graft being in a fit condition for use. The grafts should be one or two centimetres long and divested of the leaves. The stock should be at least 6 mm. in diameter. Minute directions are given as to how the graft and stock are to be cut so as to ensure perfect firmness and fixity. Grafts can be inserted at various heights, even a metre from the ground, but those at the ground-level are more to be relied on. The incision on both stock and graft should be made in the proximity of an eye, as it is in that region that cellular tissue is most abundantly formed. One or two buds may be left on the graft. Every three or four days developing buds should be removed from the stocks. In ten or fifteen days those grafts which have taken begin to shoot out vigorously, when they should be tied to a support. If the operation has been well done and the

weather favourable, 80 per cent. may be relied on for succeeding. Weak varieties may be grafted on vigorous stocks above the fourth or fifth bud. Two to three hundred grafts can be inserted in one day on this method.

W. C. W.

Grafts, The Conditions of Success with (*U.S.A. Exp. Stn. Record*, vol xii. No. 10, 1901, p. 947).—A definition of terms used, and the essential conditions for successfully uniting various families, genera, and species of plants by grafting, are given. Two groups are arranged:—(*a*) Physiological or true grafts, where the scion is entirely or partially separated from its parent, and deprived of the organs through which its mineral foods in solution are obtained; and the stock, partially or entirely separated from its upper portion which possessed powers of absorbing gaseous matter, and for elaboration of food material to form new tissues. These are considered successful after fruit and seed have been formed. (*b*) Anatomical, or grafts by approach, which are considered successful when the parts have thoroughly grown together so as to cause a wound if divided. Grafts are dependent upon certain conditions for success, namely: "intrinsic," or relative botanical structure and nature, analogy, and method of cicatrisation; and "extrinsic," conditions relating to temperature, prevention of drying or decay of tissues, and manner in which cut surfaces are held in conjunction. It was proved by experiment that quite a number of cryptogamic and monocotyledonous plants were capable of uniting their tissues, one of the most notable being *Selaginella arborea*. The above, combined with other most useful and interesting information, make these pages worthy of perusal by all those interested in the subject of grafting.—*E. F. H.*

Grape Diseases. By Newton B. Pierce (*U.S.A. Dep. Agr. Farm. Bull.* xxx.).—The "Californian Vine Disease" is described as most deadly and most obscure. It first appeared in 1884, since which time it has destroyed 30,000 acres of vines. Small yellow spots first appear on the leaf, and spread until a band of yellow is formed all down the tissue of the leaf between the main veins. The centre of this band dies and turns brown, and eventually the leaves fall and the canes turn black and die. The next year the growth is weak and the same symptoms are repeated in a more heightened form. The third year there may be no growth, or so little that the summer sun kills it. At an early stage of the disease the roots begin to show decay, the soft parts rotting and stripping from the woody parts.

At first the disease attacks only a vine here and there, but it soon spreads until the whole vineyard is destroyed. Cuttings of diseased vines may strike well and make good early growth, but when the hot season comes they at once begin to show disease. Cuttings procured from healthy stock outside the disease area have not at present shown any sign of infection. Like Peach Yellows and Silverleaf, the cause of the disease is as yet unknown.

"Powdery Mildew" is a fungoid disease too well known to all Grape growers. It attacks all parts of the vine, but is specially destructive to the bunches, causing the berries to split even when it does not actually destroy them. In summer its conidia or spores make themselves very

evident by producing a whitish powdery appearance, but as winter approaches it puts forth blackish bodies which contain and protect the spores for the next spring's growth. Dusting the surface of the ground with sulphur once before the vines blossom and once after is recommended.
W. W.

Grape-growing, Errors in. By E. Molyneux (*Gard.* p. 386, 1/6/1901).—An interesting cultural note, dealing with errors and how to avoid them.—*H. J. C.*

Grapes, New (*Agr. Gaz. N.S.W.* vol. xii. Part 6, pp. 727 and 728).—Illustrations and descriptions of three new grapes raised by Mr. Bruce Hall, of Lindaville, Bossley Park, and named 'Lady Hampden' (jet black), 'Mrs. Hall's Perfection' (pure amber), and 'Earl Beauchamp' (greenish yellow).—*A. W. S.*

Helianthella quinque-nervis. By C. Wolley-Dod (*Gard. Mag.* 2,500, p. 628; 28/9/1901).—A note with illustration of this rare hardy plant from the Rocky Mountains of Colorado. It is nearly allied to *Helianthus*, and has large flowers of a rich golden yellow.—*W. G.*

Helichrysum Gulielmi, Engler. By Sir J. D. Hooker (*Bot. Mag.* tab. 7789).—Nat. ord. *Compositæ*; tribe *Inuloideæ*. Native of Eastern Tropical Africa. A robust tomentose herb, about 2 feet high. Leaves 3-5 inches long; flower-heads 1 to 1½ inches broad; involucre, rose-red; florets, yellow.—*G. H.*

Hemerocallis fulva, L., **some Anomalies in the Flower of.** By E. Géneau. I. (*Rev. gén. Bot.* xiii. p. 337, 1901; figs. 54-69).—The abnormalities are almost confined to the lower part of the inflorescence, and consist partly of more or less complete abortion of the sepals and stamens, and of the transformation of the petals into stamens. More frequent are cases of concrescence either of the constituents of single whorls, or of those of different ones. A comparison is suggested between the normal flowers of *Scitamineæ* and these abnormalities exhibited by *Hemerocallis.*—*J. B. F.*

Herbarium Specimens, Treatment of. By Louis Clayeux (*Rev. Hort.* p. 317; 1901).—Two recipes for preservation, including natural colour.—*C. T. D.*

Hieracium. By C. Wolley-Dod (*Gard. Mag.* 2,498, p. 596; 14/9/1901).—A descriptive account of the species of the genus worthy of cultivation, together with interesting historical notes on the plants as described by ancient writers. An illustration of *H. villosum*, one of the most ornamental species, accompanies the notes.—*W. G.*

Horse Chestnuts. By G. Gordon (*Gard. Mag.* 2,499, p. 612; 21/9/1901).—A descriptive account of all the cultivated species and varieties of Horse Chestnut (*Æsculus*), together with the species of *Pavia* now merged with *Æsculus.*—*W. G.*

Hymenocallis. By Ad. Van den Heede (*Rev. Hort. Belge*, t. xxvii. p. 194, September 1901).—So named by Herbert for its "beautiful membrane" or corona. All the species have umbellate white flowers. The species and cultivation are described. —*G. H.*

Hypericum, the Genus. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 6, p. 181, June 1901).—Continuation from former number of description of species from various parts of the world.—*W. C. W.*

Ianthe. By Frederic N. Williams (*Journ. Bot.* 435, p. 289, 9/1901). Fig. 125.—A description of a new genus of *Hypoxidaceæ*, to include the glabrous species of *Hypoxis*, viz. *aquatica, curculigoides, glabella, gracilipes, leptantha, linearis, Maximiliani, monophylla, occidentalis, ovata, pusilla, Schlechteri, stellata*, and *umbraticola*, together with *Fabricia alba, Helonias minuta*, and *Fabricia serrata*. All seventeen species retain their specific names, *I. alba, linearis, ovata*, and *serrata* being of Salisbury, the rest of F. N. Williams. A clavis is given, and the plate represents *Hypoxis stellata* in the Linnean herbarium.

G. S. B.

Impatiens chrysantha, J. D. H. By Sir J. D. Hooker (*Bot. Mag.* tab. 7786).—Nat. ord. *Geraniaceæ*; tribe *Balsamineæ*. Native of Western Himalaya. It inhabits forests, 5,000 to 8,000 ft. Leaves 2 to 5 inches long, and serrated; flowers an inch or more in length, yellow, with orange streaks on the petals.—*G. H.*

Impatiens Thomsoni, Hook. f. By Sir J. D. Hooker (*Bot. Mag.* tab. 7795).—Nat. ord. *Geraniaceæ*; tribe *Balsamineæ*. Native of the Himalaya Mountains. One of the commonest sub-Alpine species from 8,000 to 12,000 feet. An erect annual, 8 to 12 inches high, with lanceolate serrated leaves 4 inches long, and rose-coloured flowers $\frac{3}{4}$ inch long.

G. H.

Incarvillea Delavayi (*Gartenflora*, p. 432; fig. 66; 15/8 1901). A figure and short description of the plant.—*J. P.*

Indiarubber. By J. H. Hart (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 2, p. 160).—A valuable paper on the growth of various rubber plants in the West Indies. Figures and descriptions are given, with cultural directions, of the following: (1) *Castilloa elastica*; (2) *Hevea brasiliensis*; (3) *Landolphia florida*; (4) *Landolphia owariensis*. *Manihot Glaziovii*, *Ficus elastica*, and *Funtumia elastica* are also described, but without figures. The two first mentioned are considered as the most promising and remunerative to plant. The necessary processes of extracting the rubber and preparing it for market are touched on.—*W. W.*

Insecticides, Nature and Use of certain. By J. L. Phillips and H. L. Price (*U.S.A. Exp. Stn. Virg.* No. 97; vol. viii. No. 2; 2/99).—Gives an account of the action of various insecticides, namely, food poisons, contact poisons, and tracheal poisons. An account is also given of the effect of various strengths of kerosene upon different kinds of fruit-trees.—*F. J. C.*

Insect Enemies (three) of Shade Trees. By L. O. Howard (*U.S.A. Dep. Agr. Farm. Bull.* 99, pp. 1–30, figs. 1–11, 1899).—Descriptions, figures, &c., are given of three different kinds of moths whose caterpillars are injurious to the foliage of various shade and ornamental trees in the United States—the "Bagworm," the caterpillar of *Thyridopteryx ephemeræformis*; the "White Marked Tussock Moth" (*Orgyia leucostigma*); the "Fall Webworm," the caterpillar of *Hyphantria cunea*; and the imported Elm-leaf Beetle, whose grubs are very destructive in some places to the foliage of Elms. Tables are given showing the comparative immunity from insects of different varieties of "shade trees." None of the four insects mentioned in this bulletin are indigenous to this country. *G. S. S.*

Insect Pests. By Walter W. Froggatt (*Agr. Gaz. N.S.W.* vol. xii. (Part 7, pp. 794 to 805).—An interesting, exhaustive, and well-illustrated article giving the life-history of the pests that have come under notice during 1900, the most noticeable being the Weed Weevil (*Lixus Mastersi*), Auger Beetle (*Bostrychopsis jesuita*), the Mediterranean Fruit-fly (*Halterophora capitata*), and a Carrot-seed pest.—*A. W. S.*

Insects, Destruction of. By E. E. Bogue (*U.S.A. Exp. Stn., Oklahoma*, 1898–99, p. 87).—This short article demonstrates the necessity of immediate attention to the destruction of injurious insects, and the usefulness of observation and common sense among farmers.

A farmer in Oklahoma noticed that a certain destructive beetle was dull and stupid in the very early morning, and trained a flock of turkeys to follow him to the spot in the early morning, when he jarred the beetles off the trees with a pole, and the turkeys ate them.

One of the best friends of the Oklahoma farmer is the little horned toad, which thrives on many bugs, caterpillars, and other insects.

The "praying mantis" also should be encouraged, as it devours plant-lice.—*C. H. C.*

Insects, Injurious (*U.S.A. St. Bd. Oregon*, 1899–1900, pp. 280–401).—Life-histories of the following injurious insects are given, together with preventive measures found most useful. The histories are as a rule very full. The Codlin Moth (8 plates); the Apple Plant-louse (2 plates, 30 figs.); the Woolly Aphis (2 figs.); the Fruit-tree Bark Beetle (4 figs.); Apple-tree Borers (3 figs.); Oyster Scale; Pear-leaf Mite (1 plate); Clover Mite (1 fig.); San José Scale (1 plate, 7 figs.); Red Spider; Peach-tree Borer (6 plates); the Bud Moth (1 plate); the Peach-twig Moth; Peach Aphis; Plum Aphis; Pear Slug (4 figs.); Hop-plant Louse (5 figs.)—*F. J. C.*

Insects injurious to the Apple-tree. By J. M. Southwick (*U.S.A. St. Bd. Agr. Rhode Is.* 1900, pp. 1–12).—A pamphlet which gives a very terse description of each of the insects which are injurious to Apple-trees in Rhode Island, their natural enemies, and the best remedies. *G. S. S.*

Insects injurious to the Violet, Rose, and other Ornamental Plants. By F. H. Chittenden (*U.S.A. Dep. Agr. Bull.* 27, 1901).—

Twenty-six insects (including *Acari*, myriapods, and crustaceans) injurious to Violets are described, the nature of the injuries they cause and the best remedies are detailed, and in most cases figures are given of the pests in their various stages of development. The writer strongly recommends the use of hydrocyanic gas, and gives full directions for its manufacture &c. as a remedy against most of these pests, but mentions that it is not of much use as a remedy against "red spider," which are easiest destroyed by the application of flowers of sulphur, either dry or as a wash combined with soapsuds. As, however, Violets are easily injured by sulphur, a wash of only soap and water is recommended in their case: it should be applied with a syringe, fitted with a spray nozzle, to the undersides of the leaves. Eleven of the insects which attack Roses are described &c., but, curiously, no mention is made of any Aphides. The bulletin closes with descriptions &c. of a caterpillar attacking the Tobacco plant, another which injures the Morning Glory, and a midge frequently found in glasshouses, whose grubs are supposed by some persons to feed on the roots of plants.—*G. S. S.*

Iris chrysantha, J. D. H. By Sir J. D. Hooker (*Bot. Mag.* tab. 7784). —Nat. ord. *Irideæ*; tribe *Moreeæ*. A native of Persia (?). Leaves linear, a foot long, and grass-like; flower, from the tip of the reflexed "fall" to the summit of the erect petals, 6 inches, all of a pale yellow colour.—*G. H.*

Iris Ewbankiana. By Sir M. Foster (*Gard. Chron.* No. 756, p. 397, fig. 152; 22/6/1901).—A new species, belonging to the *Oncocyclus* or to the *Regelia* type. Messrs. Van Tubergen obtained it from a mountain range which separates Persia from Transcaucasia. A description of the flower is given, and a figure. Sir Michael says, "It cannot be said to be a really handsome Iris, yet it has charms of its own."—*G. S. S.*

Iris florentina. By R. Brotherston (*Jour. of Hort.* p. 470; 6/6/1901).—It is shown that this is probably the 'Fleur de Lys' or 'Fleur de Luce' of old authors.—*C. W. D.*

Iris Tauri, Siehe. Sir J. D. Hooker (*Bot. Mag.* tab. 7793).—Nat. ord. *Irideæ*; tribe *Moreeæ*. Native of Eastern Taurus, Asia Minor. Flowered at Kew 1901. Perianth-tube violet; reflexed perianth leaves, dark violet with broad streaks of white. See page lxvii, *R.H.S. Journal*, vol. xxvi. fig. 131.—*G. H.*

Iron, Recipe for Uniting (*Rev. Hort. Belge*, t. xxvii. p. 151, No. 7, July 1901).—Sulphur, six parts; white lead, six parts; and borax, one part. This powder is made into a plastic mass by being rubbed together with concentrated sulphuric acid; the surfaces to be united are then smeared over with it and pressed strongly together. After six or seven days they cannot be separated even when struck with a hammer. *G. H.*

Jamaica, A Walk to Radnor. By W. J. (*Gard.* p. 76, 3/8/1901). —A most interesting article on the scenery and vegetation observed on the eight-miles route.—*H. J. C.*

Japanese Tree Cornels. By W. Goldring (*Gard.* p. 165, 7/9/1901, with fig. of *Cornus Kousa*).—Dealing with the various kinds of flowering Dogwoods.—*H. J. C.*

Jarrah Wood. By J. E. Brown (*Gard. Mag.* 2,499, p. 615; 21/9/1901).—An exhaustive account (taken from a report upon the Forests of Australia) of this widely-known and valuable timber-tree (*Eucalyptus marginata*). The account deals with the distribution of the tree and the various uses to which its timber is applied.—*W. G.*

Juncus Fauriensis. By Buchenau (*Not. König. Bot. Berlin*, No. 26, B. iii. July 1901).—Description of a new species.—*M. W.*

"Just Bot. Jah."—The fascicle, Abtheilung I., Heft 3, for 1899, published 1901, contains abstracts of papers on "Geographical Distribution" (by Höck), on "Bacillariaceæ" (by Pfitzer), on "Lichens" (by Zahlbruckner), and a "List of New Species of Phanerogamia" (by K. Schumann). The fascicle, Abtheilung II., Heft 1, for 1899, published 1901, contains abstracts of papers on "Pharmaceutical Botany" (by Siedler), on "Technical and Economic Botany" (by M. Gürke), and on "Physical Physiology" (by A. Weisse).—*P. G.*

Kæmpferia Gilbertii. By Jules Rudolph (*Rev. Hort.* p. 259; June 1901).—Remarks on cultivation. Recommended as a dwarf decorative plant for pots and borders.—*C. T. D.*

Kafir Corn, a Kansas field crop (*U.S.A. Exp. Stn., Kansas, Bull.* 93, 1900).—Describes the varieties, cultivation, harvesting, yield, uses, statistics, &c., of Kafir Corn as a grain crop and a hay crop. 582,895 acres were grown in Kansas in 1899.—*M. C. C.*

Kansas St. Agr. Coll. Exp. Stn. Bull. 101, 1901. Notes from the Plum orchard.—European, Japanese, and American varieties. Japanese Plums should be thinned to avoid the liability to brown-rot. Chart showing period of blooming of a large number of different Plums, the first variety opening its blossoms on April 7, the latest on April 29. The length of time the varieties remained in flower varied from 6 up to 14 days (Japanese flowering first), a difference of 22 days between first and last varieties to flower. Chart showing period of ripening of Plums named, June 21 to September 30 (6 to 30 days at prime); a difference of 40 days between first and last becoming ripe.

Bull. 100. The Soy Bean.

Bull. 99. Vitality of seeds in years, by Professor Bailey: Bean, 3; Beet, 6; Cabbage, 5; Carrot, 5; Celery, 8; Cucumber, 10; Lettuce, 5; Onion, 2; Parsnip, 2; Pea, 3; Radish, 5; Tomato, 4; Turnip, 5.

C. H. H.

Korshinsky (*Beih. Bot. Cent.* bd. x. ht. 6).—Obituary notice of Dr. Ssergei Ivanovicz Korshinsky, the well-known Russian botanist and author of "Heterogenesis and Evolution," "Die Nordgrenze des Schwarzerdegebietes," &c., by Prof. N. Kusnezow.—*G. F. S.-E.*

Lagerstrœmia indica. By C. Raede (*Die Gart.* p. 18, 12/10/1901).—Description, culture, and illustration of this pretty shrub. Hardy in the south-west of England. The author mentions how the plant is grown in pots or tubs in Hungary, flowering freely during the summer in the open, and wintered in a cellar.—*G. R.*

Leaf-cast of Conifers. By C. v. Tubeuf (*Kais. Ges., Div. Biology*, Leaflet No. 8; June 1901).—Pines and other Conifers while in the nursery suffer severely from a leaf-cast caused by a fungus (*Lophodermium*). Bordeaux mixture sprayed over the beds twice during July and August gives good results. A coloured plate showing sprayed and unsprayed portions is inserted.—*W. G. S.*

Lettuce "Drop" (*U.S.A. Exp. St. Hatch*, Report 10, 1898).—The loss from this disease frequently amounts to thousands of dollars in a single season in Massachusetts. The fungus causing this disease is said to be a mould (*Botrytis*). The disease makes its appearance in the stem, close to the surface of the ground, where the tissue becomes slimy and soft, and eventually the whole stem at this point disintegrates and collapses. In the succeeding report (1899) it is stated that "it is certain that the disease is not spread by *Botrytis* spores in the air, but by a mycelium or mould-like growth in the soil itself."—*M. C. C.*

Lettuce, the Rotting of Greenhouse. By Messrs. G. E. Stone and R. E. Smith (*U.S.A. Exp. Stn. Hatch Bull.* 69).—For the past five years experiments have been made with a view to investigating the diseases peculiar to Lettuce grown under glass (this being an important industry in Massachusetts), of which "rotting" is the worst, and which often causes 25 per cent. loss in the average crop.

The trouble has been prevalent for some time, but is now found to be due to various fungi, distinct from each other, and differing in their relations to the crop.

Botrytis vulgaris causes "damping-off," "mildew," &c. It is of minor importance, and can be controlled by proper cultivation.

The worst trouble consists in the rotting of the stem, and complete collapse of the plant, known as the "Drop," and caused by *Sclerotinia Libertiana.*

This fungus, causing similar diseases in other plants, spreads almost entirely by growth in the soil by organs called *sclerotia.*

Another disease, causing rotting of the leaf-blades, is caused by a species of *Rhizoctonia*, but is less prevalent than the Drop.

By sterilising the soil, either wholly or in part, the Drop and *Rhizoctonia* can be completely eradicated or suppressed.

Treating the soil with hot water, or with a steam rake, proved variously successful in reducing both the latter diseases.

Experiments were tried with various gases, by sub-irrigation, by freezing the soil, by desiccation, and by the application of such substances as lime, sulphur, charcoal, coatings of sawdust, coal ashes and sand, with very different results, but proving less effective than the application of heat.

The greatest loss occurs when the Lettuce is approaching maturity. The optimum conditions for the development of the "Drop" fungus are practically the same as those for the Lettuce.—*C. H. C.*

Lewisia Tweedyi (*Gard.* p. 386, 1/6/1901; fig. on p. 387. See also 349, 15/6/1901).—The colour description of the flowers is given, and a rough description of the plant.—*H. J. C.*

Leurocline. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 257; 8/1901). Fig. 424.—Description of a new genus of East African *Boragineæ*, near to *Sericostoma*, in which are included two species, *L. lithospermoides*, here figured and described, and *L. somalensis*=*Lobostemon somalensis*, Franchet.—*G. S. B.*

Libocedrus decurrens, Disease of. By Hermann von Schrenk (*Rep. Miss. Bot. Gard.* vol. xi. p. 67; 1900; plates 2, 4, 5). Mycological and chemical description of a disease known as "pin-rot," erroneously attributed to *Dædalea vorax*, but possibly identical with the undetermined mycelium producing "peckiness" in *Taxodium*.—*G. S. B.*

Lice, Plant. The life-history of two species inhabiting both the Witch-hazel and Birch. Theodore Pergande (*U.S. Dep. Agr. Tech. S.* No. 9, 1901, pp. 1-44, figs. 1-28).—An intensely interesting and important account of *Hormaphis hamamelidis*, Fitch, and *Hamamelistes spinosus*, Shimer, both of which alternately inhabit the witch-hazel (*Hamamelis virginica*) and the Birch (*Betula nigra*). The paper is the result of nearly twenty-two years of patient labour.—*R. N.*

Lightning and Trees. Anon. (*Jour. of Hort.* p. 210; 29/8/1901). —Statistics are given of trees struck by lightning in a Swiss wood, tending to show the comparative immunity of the Beech.—*C. W. D.*

Ligurian Littoral, Floriculture in the (*Gard. Mag.* 2,498, p. 598; 14/9/1901).—The present-day aspect of floriculture in the favoured climate of Liguria is dealt with in a concise way. Since the ravages of the vine disease (phylloxera) have rendered Grape-growing impossible in that region, the cultivation of other objects, especially of Roses, has been carried on extensively. The flowers are grown for market and large quantities are exported, and according to the report the annual value of the flowers grown and sold amounts to about twenty million francs. The flowers are sent to all European countries, and largely to England and France.—*W. G.*

Lilac, Forcing Flowers of. F. van Driessche (*Rev. Hort. Belge*, t. xxvii., p. 228, Oct. 1901), referring to an article on this subject (*Rev. Hort. Belge*, Jan. 1901) in which the writer showed how ether had the same effect as chill, as he stated that the Lilac could not flower unless submitted to frost. M. van Driessche contests this statement, describing his method of flowering the Lilac in the autumn. The flower-buds are formed early in July. All the leaves of the shoots are removed, only leaving the extremities carrying the flower-buds. After eight days vegetation recommences, and flowers can be cut on August 25.—*G. H.*

Lilacs. By G. Gordon (*Gard. Mag.* 2,492, p. 495; 3/8/1901).—A descriptive account of the species of Lilac (*Syringa*) in cultivation, with interesting historical details. A selection of varieties, new and old, of *S. vulgaris* is given, together with cultural hints both for the open air and for forcing. Illustrations are given of various varieties of double and single Lilacs and of *S. rothomagensis.*—*W. G.*

Lilacs. By W. Goldring (*Gard.* p. 96, 10/8/1901).—A most instructive and useful summary dealing fully with the various species, drawing particular attention to selection of varieties, for the benefit of those who do not happen to know the merits of the best from a catalogue list.
H. J. C.

Lilacs, Persian and Varin, Variations in. By L. Henry (*Rev. Hort.* p. 258; June 1901).—Several instances of partial reversion in hybrids; among them an occurrence of the Saugé Lilac inflorescence on a Varin Lilac.—*C. T. D.*

Lilies and their Culture. By G. B. Mallett (*Gard. Chron.* No. 759, p. 22; 13/7/1901, and following Nos.).—The various species are divided into groups; their chief characteristics are given, with the most suitable position for their growth and the best soil for growing them in.—*G. S. S.*

Lilies in California. By J. B. Davy (*Gard. Chron.* No. 760, p. 47; 20/7 1901).—An account is given of the various species of Lilies indigenous to California, their distribution, and the position in which they grow.—*G. S. S.*

Lilies, Martagon. By M. T. E. (*Gard. Mag.* 2,492, p. 500; 3/8/1901).—The writer deals fully with all the Lilies of the Martagon section, describing the species and varieties, and gives practical cultural hints. The hybrid varieties in the section are also described and commented upon.—*W. G.*

Lilies, List of cultivated (*Gard. Mag.* 2,490, p. 463; 20/7/1901). —An excellent descriptive list of all the species of *Lilium* in cultivation, the majority being suitable for open-air culture. The native country is given in the case of each species, and its date of introduction. Illustrations of *L. odorum*, *L. rubellum*, and others.—*W. G.*

Lilium speciosum. By W. T. (*Gard. Mag.* 2,490, p. 468; 20/7/1901). —A detailed account of this species and descriptions of its several varieties, with practical notes upon their cultivation under glass and in the open garden.—*W. G.*

Lily and other Exports from Japan. By A. Unger (*Gard. Chron.* No. 759, p. 24; 13/7/1901).—An interesting table is given of the value of plants and trees and Lily bulbs annually exported from Japan during the twenty years beginning with the year 1879, showing how enormously the trade has increased in recent years. In 1879 the value of trees &c. exported was £832, in 1889 £1,277, and in 1899 £8,165.

The bulbs exported were valued at £498 in 1879, in 1889 £2,502, and in 1899 at £25,956. The great rise during the last four years is owing to the enormous demand for *L. longiflorum*, and in a less degree for *L. auratum* and *L. speciosum*.—*G. S. S.*

Lobelias (Tree) of Tropical Africa. By W. B. Hemsley (*Gard. Chron.* No. 756, p. 417, fig. 156; 29/6/1901).—A short account of these remarkable plants is given. Their principal habitat is Abyssinia, where they grow at an elevation varying from 8,000 to 13,000 feet. They are also found at Kilimanjaro, and in Nyassaland there are several of these arboreal species, which differ most essentially in general appearance from those generally known in this country. They much resemble a small Palm, and appear to grow to a height of about 9 or 10 feet (not including the flower-spike, which is several feet in length). These trees are quite a feature in the landscape, which from the figure appears to be devoid of other vegetation except quite low-growing plants. Another group of species of similar habit is said to inhabit the mountains of tropical America.—*G. S. S.*

Lophotocarpus. By Jared G. Smith (*Rep. Miss. Bot. Gard.* vol. xi. p. 145; 1900; plates 53 7).—Revision of the species of the United States in this genus allied to *Sagittaria*, including *L. fluitans*, *calycinus*, *depauperatus*, and *spongiosus*, and two new species, here described—*L. californicus*, collected in 1891, at Coyote Creek, Los Angeles, California, by S. B. and W. F. Parish; and *L. spatulatus*, collected by Alvah A. Eaton, on sandy tidal beaches of the Merrimac.—*G. S. B.*

Loquat, The (*Eriobotrya japonica*) (*Jour. Soc. Nat. Hort. Fr.* p. 609).—Notes, with descriptions, of twelve varieties grown in Algiers. The selection of the twelve best sorts was made at an exhibition held in May last at Mustapha, being chosen for their size, flavour, and suitability for transport. The grafts of these have since been distributed amongst the leading growers, the practice of grafting having superseded the custom of relying on seedling plants. The importations of the fruit in Paris seem to have been much appreciated.—*G. P.*

Louse, Apple Plant. John B. Smith (*New Jersey Agr. Exp. St. Bull.* 143, March 1900, pp. 1-23, figs. 1-33 and two plates).

This pest is the *Aphis mali*, Koch, so injurious to the Apple in this country. It has no alternate food-plant, but passes the winter in the egg state, and shoots of the Apple are often covered with them.

The remedies given are:—

1. Kerosene (Paraffin) emulsion, one part; water, twelve parts.
2. Fish-oil soap, one pound in six gallons of water.
3. Tobacco in decoction equal to an extract from one pound of tobacco in two gallons of water.

"Any of these will answer, and all of them will fail to eradicate, partly because of the difficulty of hitting all the examples when the tree is in full foliage." Trees known to be infested with this pest should be closely pruned, and the prunings burnt.—*R. N.*

Louse, Pea, the Destructive Green (*Nectarophora destructor*, Johns). F. H. Chittenden (*U.S. Dep. Agric. Circ.* No. 43, s.s. pp. 1-8, numerous figures).—The insect is described, and an estimate of the loss caused by its ravages during the year 1899 along the Atlantic Coast States reached the sum of $3,000,000. Besides Garden Peas, Sweet Peas, Red and Crimson Clover, Vetches and Tares are also affected. Several parasitic and predaceous insects attack the lice, but do not increase in such numbers as to limit their multiplication.

The methods of control are:—

1. *Kerosene Soap Emulsion.*—The application of this diluted with twelve parts of water has been found the most effective as an insecticide.

2. *The Brush and Cultivator Method.*—The Peas are grown sufficiently wide apart to admit a one-horse cultivator between them. The lice are then brushed from the plants with boughs of Pine with their leaves on, and a cultivator follows down the rows as soon as possible to destroy the fallen insects.

3. *Brush and Pan Method.*—This method consists of jarring the lice from the plants into long shallow pans in which a little paraffin is placed to kill the insects.

4. *Cultural Methods.*—The value of early planting is set forth, as also the rotation of crops, avoiding leguminous plants such as Clover and Vetch.

The winter food-plant is not given, and is apparently unknown.

R. N.

Mahonia, a Monograph of the Genus. By F. Fedde (*Engl. Bot. Jahrb.* xxxi. pp. 30 133, with five figures in the text; 16/8 1901).—An account of the general morphology and anatomy of the genus is followed by a systematic revision. The author recognises thirty-seven species, distributed among four groups.—*A. B. R.*

Maine Agr. Exp. Stn., Report (1900).—Fertiliser inspection. Investigation on influence of pollen: in Pea, Kidney-bean, Indian Corn, influenced the mother-plant. No relation between amount of pollen produced by a plant and amount required for fecundation. In Egg-plant, Bean, and Cucumber the ovary developed in absence of pollen, but where pollen withheld, no perfect seeds formed. The amount of pollen influenced the form, size, and quality of fruit.

Form and size of Tomato fruit directly dependent on amount of pollen, a small amount resulting in small and deformed fruit. Experiments with Tomatos: Earliness and productiveness are in direct ratio with earliness of setting in the field. Trimming the plants after a part of the fruit had set increased the yield by more than one-third. Crossing between small-fruited plants of prolific habit and the ordinary large-fruited type was found to be a promising method of securing a valuable type for localities where the season is short. Radish.—Large seed was found to produce 30 to 50 per cent. more first-class roots than small seed. Spraying.—Paris green found less injurious than London purple or white arsenic. Most wormy fruits from sprayed trees were entered from the

side or base, while in fruits from unsprayed trees the entrance at the calyx was largely in excess. The most effective fungicide for apple-scab was Bordeaux mixture.—*C. H. H.*

Manuring by means of Green Crops. By J. R. Bovell (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 2, p. 212).—An exceedingly useful and carefully-drawn-up paper on the methods adopted in various countries, of the plants used for green crop, and of the advantages secured.—*W. W.*

Maranta Lujaiana, Hort. Lind. By O. K. (*Rev. Hort. Belge,* t. xxvii. p. 241, col. pl.), nat. ord. *Scitamineæ*; native of Congo.—After observing that this genus and *Calathea* supply several useful species, the latter name being usually replaced by *Maranta*, the author refers to this species and *M. Liebrechtsiana*, from the same locality, as introduced in 1901. As no flowers or fruit have been obtained, some doubt rests with the generic name. Only a single species, *M. arundinacea*, is as yet known from the Congo. The leaves of *M. Lujaiana* are ovate acute, bright green above, and of a coppery orange colour below. It is used by the natives for coagulating the latex of leaves into caoutchouc.—*G. H.*

Marsdenia spissa. By Spencer Le M. Moore (*Journ. Bot.* 461, p. 260; 8/1901).—Description of a new species from British East Africa.
G. S. B.

Mayaca. New species from Africa. By M. Gürke (*Engl. Bot. Jahrb.* xxxi., *Beibl.* 69, pp. 1, 2; 16/8/1901).—A new species from Benguella, collected by Dr. Baum. *A. B. R.*

Mosses, Miscellaneous Notes on. By Th. Herzog (Freiburg i. B.) (*Beih. Bot. Cent.* bd. x. ht. 6, p. 390).—The paper gives localities and altitudes of sixteen rare Mosses in Switzerland.—*G. F. S.-E.*

Moth-catchers. By Prof. J. M. Steadman, of Columbia, Mo. (*Amer. Gard.* xxii. pp. 590, 591; 21/8/1901).—Giving a consensus of opinion over a wide area that the catching of moths by fruit-growers by means of lanterns and other lights will do more harm than good, inasmuch as friends are killed as well as foes, and, further, that the worst enemies of the fruit-grower, such as Codlin-moths &c., are not to be trapped by these means.—*C. C. H.*

Mullein Moth. Anon. (*Jour. of Hort.* p. 69; 18/7/1901).—A figure and life-history of *Cucullia Verbasci,* the Mullein moth.—*C. W. D.*

Musk-melon Disease (*U.S.A. Exp. St. Hatch,* Report 11, 1899).—A destructive disease of the leaves described, and attributed to a species of *Alternaria.* This being the earliest notice, no experiments had been made to check it.—*M. C. C.*

Myosotis for the Winter. By P. Perret (*Bull. R. Soc. Tosc. Ort.* 8, p. 281; August 1901).—The culture was made by the author from cuttings, as these form robuster plants and involve less labour than when the plants are grown from seed. The cuttings are made at the end of

March and beginning of April; on very sunny days the pots in which they are set are plunged in water. When rooted each plant is placed in a separate small pot, in soil similar to that used for Chrysanthemums, and the pots placed in a cool greenhouse and covered with glass until the plants have become established, after which they are exposed to the air. In May and June, when the pots have become encircled by the roots, the plants are placed in the open ground, preferably on a rainy or cloudy day. During the second half of August they should be taken up and placed in pots of 20 or 25 cm., which should be plunged in soil in the open and fully exposed to the sun; it is needful to give them abundance of water three or four times a day. In September, when new roots have been emitted, one or two applications of liquid manure will stimulate their growth. Before frost sets in the plants are to be removed into a moderately warm house, and watered during the winter once or twice with liquid manure. They will flower in January or February. A temperature of 10° C. should not be exceeded.—*W. C. W.*

Nelumbium. By Alph. de Vreeze (*Rev. Hort. Belge*, t. xxvii. p. 149, No. 7, July 1901).—A short article on the distribution, history, and culture of this genus.—*G. H.*

Nelumbium speciosum album plenum (Shiroman) (*Gard.* p. 158, 7/9/1901; fig.).—Describing characteristics and colour of this variety; also *N. s. roseum plenum*, as shown at the Royal Horticultural Society's meeting by Mr. Hudson, from Gunnersbury House Gardens.—*H. J. C.*

Nematodes as Enemies of Horticulture. By Dr. Adolf Osterwalder (*Gartenflora*, p. 337; 1 coloured plate and fig. 51; 1/7/1901)—The chief nematode plant parasites belong to the genera *Tylenchus*, *Aphelenchus*, and *Heterodera*. Representatives of the two former cause diseases of the leaves of Gloxinias, Begonias, Chrysanthemums, Calceolarias, *Saintpaulia ionanthe*, various species of Ferns, and injure the stems of *Aucuba japonica*. They also do considerable damage by attacking the callus or healing tissue at the base of Chrysanthemum cuttings. The leaves of the plants first become spotted on the under surface; then the upper surface shows yellowish spots which die and turn brown, the whole leaf being ultimately destroyed. The eelworms live in the spongy parenchyma of the leaf and destroy it. The species *Heterodera radicicola* attacks and produces galls upon the roots of *Cyclamen persicum*, Begonias, and occasionally on vine roots. No cure for an infected plant is known; the only means to reduce the attacks of these parasites is to endeavour to prevent them from gaining an entrance into the soil and pots used for the growth of these plants. Diseased plants should not be thrown on compost heaps, and infected leaves should be picked off the plants and burnt as soon as the trouble is noticed. Sterilising the potting soil by heat, or the application of boiling water, is recommended, and pots which have contained diseased plants should be disinfected by means of boiling water before being used again. Care should be taken to prevent the introduction of diseased stock into the houses (see also "Worms").—*J. P.*

Nemesia. By Ch. Chevalier (*Rev. Hort. Belge*, t. xxvii., p. 222, Oct. 1901).—Nat. ord. *Scrophularineæ.* Description and cultivation of species of this genus.—*G. H.*

Neomullera damarensis. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 265; 8/1901).—Description of a new species from Damaraland.
G. S. B.

Nerines. By W. T. (*Gard. Mag.* p. 673; 19/10/1901).—Descriptive and cultural notes on the now numerous species and varieties of the *Nerine* (Guernsey Lilies), a class of beautiful bulbs not so much cultivated in gardens as they should be.—*W. G.*

New Jersey Agr. Coll. Exp. Stn. No. 86. Spraying for insect and fungoid pests of the orchard and vineyard:

Bordeaux Mixture formula:	Sulphate of copper	6 lb.
	Quicklime . .	4 ,,
	Water . .	22 galls.

Dissolve the copper sulphate in one gallon of hot water, and in another vessel slake the lime with a gallon of water; add the milk of lime slowly to the copper solution, stirring constantly, and strain through a sieve or coarse gunny-sack; finally add twenty gallons of water, and the mixture is ready for use.

Good results are obtained with half and one-third this strength, especially for last spraying of some crops.

No. 119. Apple-growing in New Jersey. Thinning fruit recommended. Good average yield, 100 barrels (225 bushels) per acre.

No. 149. Strawberry leaf roller (*Phoxopteris comptana*); Strawberry root louse (*Aphis Forbesi*).

No. 141. Forcing Tomatos. Maximum yield, plant given 2½ square feet ground area, yielding 28½ oz. per square foot; largest fruit with 3 square feet. Farmyard manure best, then nitrate of soda, sulphate of ammonia, blood—the order of merit of nitrogenous manures. Benches preferred to boxes or pots. Single-stem training superior to three-stem method.

No. 142. Pear growing in New Jersey. Distance of setting ranges from 15 to 40 feet each way; average distance, 18 by 22 feet. Manuring 150 lb. of bone meal, 100 lb. muriate of potash. Nitrate of soda if nitrogen needed. Life of Pear-trees in the State 12 to 100 years; average 27 years. Average yield 150 to 200 bushels per acre. Mixing varieties grown is desirable, since many varieties fail to set fruit if planted alone. 'Keiffer,' 'Bartlett,' 'Clapp,' 'Le Conte,' 'Seckel,' and 'Lawrence,' leading sorts. Prune in late winter or early spring, before the buds start. Thinning the young fruit produces better ripe fruit and saves the energy of the trees.—*C. H. H.*

Nierembergia frutescens atroviolacea. By Ch. Grosdemange (*Rev. Hort.* p. 388; July 1901).—Corolla of deeper violet than the type, and much larger. Recommended for warm situations; needs winter protection. Forms small bushes; very floriferous; and blossoms well displayed above the linear foliage.—*C. T. D.*

Nomenclatorial Principles. By M. L. Fernald (*Bot. Gaz.* vol. xxxi. p. 188; No. 3).—Gives an account of some recent publications bearing on this subject, as Heller's "Catalogue of North American Plants north of Mexico" (1900-1), which is criticised; Professor Underwood's "Our Native Ferns and their Allies"; Britton and Brown's "Illustrated Flora"; and the Botanical Club's "Check List" of north-eastern plants. These are compared and synonyms criticised, and numerous inconsistencies as to the treatment of species by the authors are pointed out.
G. H.

Nuts. By John R. Parry (*U.S.A. St. Bd. Rhode Isl.*).—Chestnuts succeed best on high well-drained spots and in soil of a sandy nature. They yield as many bushels an acre as Wheat does and at vastly less trouble and expense. They can be ground into flour that makes very superior bread. The writer prophesies that they will "inevitably" supplant wheat before long.

The Chinquapin is like a small Chestnut, but makes up for its lack of size by its productiveness and by the fact that it will bear a temperature of 20 deg. below zero; its flour is also even sweeter and more delicate than that of Chestnuts.

Walnuts.—A large number of species and varieties are discussed, the palm being given to the Japanese *Juglans cordiformis*, which is said to be "of inestimable value."

Many varieties of the Hickory are also discussed, their kernels being said to be in great demand among confectioners.—*W. H.*

Nymphæa flavo-virens, Lehm. By Sir J. D. Hooker (*Bot. Mag.* tab. 7781).—Nat. ord. *Nymphaeaceae*; tribe *Nymphaeae*. Nearly allied to the Mexican *N. gracilis* race; first described 1852, from a plant growing in the Botanical Gardens of Hamburg. Probably Mexican. Flowers 5 inches across; sepals white; petals narrowly lanceolate, white.—*G. H.*

Oak and Ash. By J. Simpson (*Gard.* p. 78, 3/8/1901).—Peculiarities during the barking season of the Oak and in general cultivation. The differences in the quality of timbers in Ash-trees and its decaying characteristics are dealt with.—*H. J. C.*

Odontoglossum crispum Pittianum. By H. J. C. (*Gard.* p. 439, 15/6/1901; fig.).—Giving particulars of this wonderful variety, which was exhibited on June 4 at the Drill Hall.—*H. J. C.*

Odontoglossum × Dicranophorum. By R. A. R. (*Orch. Rev.* p. 31, Jan. 1901).—Giving interesting particulars whereby this natural hybrid may be identified.—*H. J. C.*

Odontoglossum maculatum Thompsonianum (*Orch. Rev.* p. 337, fig., Nov. 1901).—*H. J. C.*

Odontoglossum Natural Hybrids. By R. A. Rolfe (*Orch. Rev.* p. 260, Sept. 1901).—The Mexican section of natural hybrids are most ably described and classified. This should prove of good service to Odontoglossum growers.—*H. J. C.*

Œnotheras, and How to Grow Them. By S. Arnott (*Gard. Chron.* No. 758, p. 347; 1/6/1901).—The names of the most attractive species are given, with a short description, and hints as to growing them.
G. S. S.

Omania. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 258; 8/1901). Fig. 424.—Description of a new monotypic genus of *Scrophulariaceæ*, next to *Bungea*, from Oman, Arabia, and of the species *O. arabica*.—*G. S. B.*

Onion-culture. By R. L. Watts (*U.S.A.* Dep. Agr. Bull.* 39, 1896).—Selection of soil, preparation, previous crop, fertilising, cultivation, American and European varieties, irrigation, harvesting, storing, production of Onion-seed. Soil should be rich in organic matter, heavy dressing farmyard manure, 200 to 400 lb. nitrate of soda in four equal dressings, also potash and phosphate manures, plants transplanted three inches apart in rows twelve inches apart, frequent stirring, hand weeding in early stages, wheel-hoe later. Good crop—500 to 1,000 bushels per acre.—*C. H. H.*

Opuntia bicolor. By R. Irwin Lynch (*Gard.* p. 429, 15/6/1901, with fig.).—Giving particulars as to requirements for culture successfully adopted in the Cambridge Botanic Garden.—*H. J. C.*

Orange, Bergamot (*Bull. Bot. Dep. Jam.* vol. viii. p. 84).—The cultivation is recommended for the oil or essence of Bergamot. 100 fruits yield 2½ to 3 oz. It is principally grown in Calabria, Sicily, and S. France. Method of manufacture quoted from *Pharmacographia*, 2nd ed. p. 122.—*G. H.*

Orange Culture in British Gardens. By M. H. (*Gard. Mag.* 2,500, p. 625, 28/9/1901).—The article on this subject is intended to stimulate the interest in Orange and Lemon culture under glass in this country, and particularly of the Tangerine variety, which, when well grown and fruited, is really a very ornamental pot plant. As so many like to grow Orange-trees in pots and tubs, the cultural notes may be useful.—*W. G.*

Orange-trees. By W. C. Stubbs (*U.S.A. St. Bd. Louis.* 13*th Ann. Rep.* 1900).—This report shows that fifty varieties of Oranges are being grown on the Audubon Park Experiment Station, besides over a hundred Orange-trees, being hybrids between the hardier sweet varieties and the non-edible Japanese "trifoliate," but they have not yet borne fruit.
C. H. C.

Orchards, Beautiful. By Alger Petts (*Gard. Mag.* 2,501, p. 640, 5/10/1901).—The writer describes how an old orchard may be made beautiful by planting between the trees masses of hardy perennials for summer and autumn effect, and the hardiest of the Narcissi and other bulbs that will flourish in grass for producing colour effects during spring.—*W. G.*

Orchid House, Plan of. By G. Bartsch (*Gartenflora*, p. 400; figs. 61, 62, and 63; 1/8/1901).—*J. P.*

Orchids. By Gustav Bartsch (*Gartenflora*, p. 286; 1/6/1901).—Concluding article of general cultural instructions.—*J. P.*

Orchids from Seed. By E. O. Orpet (*Orch. Rev.* p. 110, April 1901).—Interesting particulars as to the methods in practice for raising seedling Orchids in America.—*H. J. C.*

Ornamental Planting, Growth, and Present Tendencies of. By Prof. J. C. Blair (*U.S.A. Hort. Soc. Ill.* 1900).—"Instead of representing by means of pigments, picturesque or beautiful trees, graceful plants, striking effects of light and shade, and wandering streams, he (the landscape gardener) takes from Nature's bounty his living materials, and hand in hand with her creates what the painter can only copy." An historical and practical paper.—*D. H.*

Orthosiphon gofensis. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 263; 8/1901).—Description of a new species from British East Africa. *G. S. B.*

Osmunda, A New. By C. T. Druery (*Gard. Mag.* 2,497, p. 577, 7/9/1901).—This well-known hardy Fern specialist describes and illustrates a new form of the Royal Fern (*Osmunda regalis*). This variety has the pinnæ of the fronds much divided, which gives them a feathery appearance. The variety is provisionally named *decomposita.*—*W. G.*

Ostrowskia magnifica (*Gartenflora*, p. 430; fig. 65; 15/8/1901).—A figure and short description of the plant.—*J. P.*

Othonna crassifolia. By S. Mottet (*Rev. Hort.* pp. 334, 335; July 1901; one woodcut).—South Africa. Although not hardy, highly recommended for rockeries or other dry situations. Flowers freely; blooms yellow, like small Marguerites.—*C. T. D.*

Overfeeding of Plants (*U.S.A. Exp. St. Hatch*, Report 11, 1899).—Attention is called to this subject, and instances given in which the injudicious use of fertilisers is commented upon as causing eruptions, blisters, and other evidences of disease, such occurrences being brought about by too much fertiliser, or excessive watering.—*M. C. C.*

Oxalis dispar, N.E. Br. By Sir J. D. Hooker (*Bot. Mag.* tab. 7794).—Nat. ord. *Geraniaceæ*; tribe *Oxalideæ.* Native of British Guiana. Flowers freely at Kew. It is a small undershrub, about 2 feet high, with trifoliate leaves, leaflets 2 to 3 inches long; flowers, 1 inch diam. Golden yellow. *G. H.*

Packing Plants and Seeds for Long Journeys. By J. H. Hart (*Journ. Imp. Dep. Agr. W.I.* vol. i. No. 3, p. 296).—Very valuable directions. The form and construction of three varieties of Wardian cases are given. The packing of fruit is dealt with in relation to transport to and

from the tropics. Special methods for preserving the vitality of seeds for tropical journeys are described.—*W. W.*

Pæonia lutea, Franch. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,788).—Native of the mountains of Yunnan, China. It is remarkable for its woody stem and yellow flowers, 3 inches across, fully expanded. It flowered at Kew 1900.—*G. H.*

Pansy Disease, A New (*U.S.A. Exp. Stn. Hatch, Report* 11, 1899).—A new disease has appeared among Pansies, spotting the leaves and disfiguring the blossoms, which has been described in *Botanical Gazette*, March 1899, under the name of *Colletotrichum Violæ tricoloris*. Spraying with Bordeaux mixture seems to have done a little good, but it was too late in the season to be very effective.—*M. C. C.*

Parasia (Belmontia) Thomasii. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 260; 8/1901).—Description of a beautiful little new species from the Orange River Colony.—*G. S. B.*

Parasitism of Species of Botryosporium. By V. Peglion (*Zeit. f. Pflanz.* bd. xi., ht. 2 and 3, p. 89; June 1901).—A critical review to prove that these fungi, frequently found on sickly plants, are not the cause of disease, but only follow on a weakened condition due to other causes.—*W. G. S.*

Peach Foliage and Fungicides. By W. G. Sturgis (*Rep. Connect. Agr. Expt. Station*, October 31, 1900; Part iii. pp. 219–254; pls. 3–5, 1901. Quoted in *Bot. Gaz.* vol. xxxii. p. 66, No. 1).—Experiments were made with (1) Bordeaux mixture; (2) with a soda-B, in which soda replaced lime; (3) with ammoniacal solution of copper carb.; (4) with cop. acetate, and (5) with potassium sulphide. The first was injurious unless very weak; (2) and (3) equally injurious; (4) harmless, but subacetate injurious; (5) was harmless and a fairly good fungicide.—*G. H.*

Peach-leaf Curl. By Newton B. Pierce (*Bot. Gaz.* vol. xxxi. p. 207; No. 3).—Has notice of this work, which deals with the nature and treatment of the disease. It is published in *Bull.* 20, *Div. of Veg. Phys. and Path., U.S. Dep. of Agr.*, 8vo., pp. 204; figs. 10; plates 30 (1900). The losses by this disease are estimated at $3,000,000 annually. The fungus is *Exoascus deformans*. It is shown that the perennial mycelium of this fungus is responsible for only about 2 per cent. of the infections each spring, the others being due to spores which have remained over winter in the crevices of the bark and between the bud-scales. Ninety-five to ninety-eight per cent. of the injury to the foliage can be prevented by treating the trees, while still dormant, with various sprays, the best being a Bordeaux mixture containing five pounds each of copper sulphate and lime, and forty-five gallons of water. The sprays are successful only when applied while the tree is dormant, preferably one to three weeks before the flower-buds open.—*G. H.*

Peanut (*Bull. Bot. Dep. Jam.*, vol. viii. p. 87).—A description of the preparation of oil at Marseilles, where more is extracted than

anywhere else. Seventy-one thousand tons reached Marseilles in 1900. The sources of supply are Bombay, Mozambique, and Senegal. The oil is used for many purposes, as nutrition, lighting, lubricating and blending. It is a component of the famous Marseilles soap.—*G. H.*

Pears, their Commercial Culture. By M. B. Waite (*U.S.A. Dep. Agr.* 1900, p. 369).—A treatise on growing Pears for profit, with full instructions for their cultivation.—*C. W. D.*

Pear-leaf Blister Mite (*Gard. Mag.* 2,491, p. 489, 27/7/1901).—An illustration of this insect pest (*Phytoptus pyri*), with descriptive note, and the remedy against its attacks, by spraying.—*W. G.*

Pelargonium Endlicherianum (*Gard. Chron.* No. 765, p. 149, fig. 48, 24/8/1901).—This species is a native of Cilicia, and is found to be nearly hardy in Sir Trevor Lawrence's garden near Dorking. It bears a tuft of from five to fifteen glowing pink flowers, veined with a darker purple, on a stem from one to two feet long, and is worthy of the attention of growers of herbaceous plants.—*G. S. S.*

Pellæa atropurpurea cristata. By William Trelease (*Rep. Miss. Bot. Gard.* vol. xii. p. 77, 1901). Plate 34.—Description of a crested variety of this Fern from limestone, near Eureka, Missouri, discovered by Gustavus Pauls in 1899.—*G. S. B.*

Pentstemon, Species of. By Ed. André (*Bol. R. Soc. Nac. Hort.* iii. pp. 20-22; one fig.; 1901).—A descriptive list of thirty-one species, and some striking hybrids, embracing those most desirable for cultivation on account of the beauty and quantity of bloom produced. Under each species the colour of the flower is stated, also the general form and colour of the leaves. *P. heterophyllus* is described in detail, as, although this species was introduced into our gardens from New California by Douglas in 1834, it is not as much utilised as it deserves to be.—*G. M.*

Perfume Plants in Victoria (*Dep. Agr. Vict. Ann. Rep.* 1888). States that twenty-seven kinds of scent plants have been cultivated experimentally on the Dunolly scent farm, and only five have given satisfactory results. These are *Lavandula vera*, African Geranium, Roses, Peppermint, and Rosemary, which might even be reduced by exclusion of the latter two. It also reports the closure of the Cheltenham experimental scent farm, after upwards of two years' trial, on account of the results being unsatisfactory.—*M. C. C.*

Persimmons. By R. L. Watts (*Bull. Univ. of Tennessee Agric. Exp. St.*; 10 illustrations; 1899).—The author deals with the botanical characters, varieties, cultivation, and propagation of the American and Japanese Persimmon, with notes on the chemistry of the fruit by J. B. M'Bride.—*D. H.*

Petunia superbissima Varieties. By Ed. Michel (*Rev. Hort.* p. 350; August 1901).—Large wide-throated flowers; tall habit. Recommended for pot culture or on trellis.—*C. T. D.*

Phaius tuberculosus. By R. A. Rolfe (*Orch. Rev.* p. 41, Feb. 1901). —The distinction between the species which has been grown for so many years in gardens as *P. tuberculosus* (now transferred to *P. simulans*) and the original variety described by M. Thouars. The conditions also under which it was found growing by M. Warpur in Madagascar are also referred to.—*H. J. C.*

Philippia keniensis. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 259; 8/1901).—Description of a new species from Mount Kenia. *G. S. B.*

Philodendron crassum. By A. B. Rendle (*Journ. Bot.* 464, p. 277; 8/1901).—Description of a new species, near *P. cannæfolium*, flowered by Mr. A. H. Smee at Hackbridge, Surrey, and received by him from Rio de Janeiro.—*G. S. B.*

Phytography, a Contribution to the Clearing up of some Ideas in. By F. Krašan (*Engl. Bot. Jahrb.* xxxi., *Beibl.* 69, pp. 8-38; 16/8/1901).—A discussion of the question of the limitation of species, varieties, &c.—*A. B. R.*

Pieris Brassicæ, Natural Enemies and Artificial Remedies for (*U.S.A. Exp. Stn. Record*, vol. xiii. No. 2, 1901; p. 159).—In regard to attacks and ravages by this species, it is recommended that the destroying of eggs should be placed first. This is considered quite practicable, as they are a bright yellow, and are deposited in groups of considerable size. Experiments with various chemicals were conducted, but in many cases little effect was observed. A potash soap solution of $1\frac{1}{2}$ to $2\frac{1}{2}$ per cent. strength, quickly destroyed caterpillars without injury to plants. The relative importance of insects parasitic on the species is noted. *E. F. H.*

Pineapples, diseased. By Prof. Webber (*Bull. Bot. Dep. Jam.* vol. viii. p. 83).—The fungus attacks the root, but no remedy is effective. Only eradication of the diseased plants, and selection to secure a disease-proof race, if possible.—*G. H.*

Piper nigrum. By E. Henze (*Die Gart.* p. 583–584; 7/9/1901).—This well-known plant is flowering in the Orchid-house of the Friedrich Wilhelm Garden in Magdeburg.—*G. R.*

Planes. By W. J. Bean (*Gard. Chron.* No. 754, p. 363; 8/6/1901).—A brief review of this genus of trees is given, in which the names of the different species and the way in which they vary from one another are detailed. See also a note on page 369 of a paper by M. F. Jaennicke on planes in the "Botanisches Centralblatt," 8/1901.—*G. S. S.*

Plants in Rooms. By Garten-Inspector Weidlich (*Gartenflora*, p. 281; 1/6/1901).—Useful and concise remarks on the care and

management of Palms, Ferns, Dracænas, Camellias, Azaleas, and other plants commonly grown as window-plants or in rooms.—*J. P.*

Plectranthus keniensis. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 264; 8/1901).—Description of a new species near *P. flaccidus*, from Mount Kenia.—*G. S. B.*

Poisonous Plants. By V. K. Cheshunt (*U.S.A. Dep. Agr.* 1900, p. 305).—A history of the investigation of the losses of stock on ranches caused by poisonous plants, especially of the genera *Cicuta, Delphinium*, and *Zygadenus*.—*C. W. D.*

Polyactis cinerea, Destruction of.—M. Beauverie (*Rev. Hort. Belge*, t. xxvii. p. 172, August 1901) has succeeded in rendering plants immune from attacks of this fungus, *e.g.* Begonias, by growing them in earth which has been treated with the liquids secreted in the culture of *Polyactis* (*Botrytis*). This result is interesting as running parallel with the serum-therapeutics in man, and is important to horticulturists as furnishing the means of preserving plants from this very common disease.—*G. H.*

Pomology (*U.S.A. St. Bd. Connec.*, 34th Report, 1900).—J. H. Hale states the lessons in Pomology learnt in 1899 and 1900, showing the importance of the fruit industry. The results and lessons of the "great freeze" in February 1899, also under conditions of excessive drought, were the stimulation of better tillage and better care all over the country. "Some of the largest and most beautiful Peaches, Pears, and Apples have been grown, probably the finest Peaches ever grown in Connecticut, were produced this year in those orchards where careful attention had been given to culture."—*M. C. C.*

Poplar Plantations in Sweden. By W. E. D. (*Gard. Chron.* No. 753, p. 356; 1/6/1901).—An account is given of the different species whose wood is used in the manufacture of matches, and the best methods of their cultivation for this purpose.—*G. S. S.*

Potamogeton natans. By G. M. Holferty (*Bot. Gaz.* vol. xxxi. p. 339, No. 1; 2 pl. and 1 fig.).—Describes the ovule and embryo in formation.—*G. H.*

Potato Crop, Causes of the Failure in 1897 (*U.S.A. Exp. St. Hatch*, Report 10, 1898).—The causes are concluded to be the excessive rainfall of the previous season. The small yield and large amount of rotting were easily to be attributed to this source. The *Phytophthora* made its appearance early in August, and developed very extensively during the month.—*M. C. C.*

Potato Diseases and their Treatment. By B. T. Galloway, Chief of the Div. of Veg. Phys. and Path. of the U.S. Dep. of Agric. (*Bull. Bot. Dep. Jam.* vol. viii. p. 89).—This deals with "Potato-leaf Blight," or "Early Blight" (*Alternaria solani*); "Potato Blight, Late Blight or

Rot" (*Phytophthora infestans*); Brown Rot (*Bacillus solanacearum*); Potato Scab (*Oospora scabies*) and "Tip Burn, Leaf Burn or Scald."
G. H.

Potato, its Value as Food. By C. F. Langworthy (*U.S.A. Dep. Agr.* 1900, p. 337).—This subject in all its aspects is fully discussed from a medical point of view, showing especially the difference of value under different modes of cooking.—*C. W. D.*

Potato Frog-fly. By F. M. Duncan (*Gard. Mag.* 2,495, p. 544, 24/8/1901).—A descriptive account of this insect pest (*Eupteryx solani*), together with illustrations of the perfect insect and pupa. The remedy for its extermination by spraying with Bordeaux mixture or other insecticide is recommended.—*W. G.*

Potatos, Cookery of. By H. Roberts (*Gard. Mag.* 2,501, p. 643, 5/10/1901).—Various recipes are given for cooking Potatos, preceded by an interesting historical account of the introduction to Europe of the Potato.—*W. G.*

Primula Arctotis hybrida. By G. Arends (*Die Gart.* p. 577; 7/9/1901).—The author describes, in an interesting article, how he acquired from England a *Primula* under name *P. viscosa nivalis* (identical with *P. Arctotis*, Kern, var. *albiflora*), but, being unable to seed it, crossed it with the white *P. pubescens ciliata*, resulting in vigorous growing white-flowering forms similar to the English *P. viscosa nivalis.* By again intercrossing with *P. viscosa* and other allied species, the raiser obtained a fine lot of large-flowering forms with yellow, pink, purple, and red flowers, resembling much the parent *P. viscosa nivalis* as far as growth is concerned.—*G. R.*

Primula capitata and Primula cashmeriana. By F. Rehnelt, Garteninspector in Giessen (*Die Gart.* pp. 26 & 27, 19/10/1901).—Protest, against the wrongful use of these names in Germany. *P. capitata*, summer flowering, with blue heads of flowers, is less known, as in England, while *P. cashmeriana*, spring flowering, with lilac-purple flowers, usually goes under the name of *P. capitata.* Full description and illustration of leaves &c.—*G. R.*

Primula kewensis. By J. Fischer (*Die Gart.* p. 595; 14/9/1901). —Full description and culture of this fine hybrid *Primula*, already mentioned in several English journals.—*G. R.*

Primula, New Alpine (*Gard. Mag.* 2,485, p. 371, 15/6/1901).—Under the name of *Primula viscosa*, 'Mrs. J. H. Wilson,' a new variety is described and illustrated. It has larger flowers than those of the type, and they are of a rich violet-blue colour. It originated as a seedling in Mr. Wilson's garden at Handsworth, Sheffield.—*W. G.*

Pruning and Care of Shade and Ornamental Trees and Shrubs. By O. C. Simonds (*U.S.A. Hort. Soc. Ill.*; 2 plates, 1900).—

Deals with the preparation of the ground and of the trees before planting, selection of kinds, proper methods of pruning, &c.—*D. H.*

Pseudosopubia Delamerei. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 261; 8/1901).—Description of a new species from British East Africa, in a genus recently discriminated by Engler from *Sopubia.*
G. S. B.

Pueraria Thunbergiana. By C. Raede (*Die Gart.* p. 604; 21/9/1901).—Description, culture, and use.—*G. R.*

Queensland, Cultivation of Indigenous Plants in (*Qu. Agri. Journ.* ix. pt. 2, August 1901). —Hon. A. Norton recommends the cultivation of *Stenocarpus sinuatus*, locally known as the Tulip-tree, *Barklya syringifolia*, *Castanospermum australe*, *Grevillea robusta*, the crimson *Sterculia*, and others. Amongst climbers, *Millettia megaspermum*, *Bignonia jasminoides*, *Passiflora aurantia*, *Hoya australis*. Garden flowers, such as *Eurycles Cunninghami*, *Calanthe veratrifolia*, *Eurycles amboinensis*, and *Curcuma australasica.*—*M. C. C.*

Quince Rust (*U.S.A. Exp. St. Hatch*, Report 10, 1898).—This disease, caused by *Gymnosporangium clavipes*, affects principally the fruit, and also the young wood. Was unusually prevalent during the preceding season.—*M. C. C.*

Rabbits, Extermination of. By O. Appel and A. Jacobi (*Kais. Ges., Div. Biology*, Leaflet No. 7; April 1901).—Recommends a drastic method of treating warrens. A piece of canvas sacking (one foot square) moistened with bisulphide of carbon (an evil-smelling compound fatal to life) is pushed down each hole and the mouth closed with earth; every hole is to be treated at a time when rabbits are in them. Cost of materials per hole is less than a penny.—*W. G. S.*

Railway Tariffs for Fruit &c. from S.W. France (*Jour. Soc. Nat. Hort. Fr.* p. 583).—New and much reduced tariffs are recorded as being adopted by the Orleans and Northern Railways of France over the Eastern Railway at Paris to the northern ports of Boulogne, Calais, or Dunkirk, with the idea of favouring the exportation to England of fruits and vegetables of the country from Brive to Montauban. A charge of 40 fr. per 1,000 kilos is made, including all charges.—*G. P.*

Rainfall, May 1901. Anon. (*Agr. Jour. Cape G.H.* vol. xix. No. 1, pp. 63–66, July 1901).—Returns from various provinces in South Africa.
R. N.

Raspberry Moth, The. By F. M. Duncan (*Gard. Mag.* 2,491, p. 480, 27/7/1901).—An account of the Raspberry Stem-bud Moth (*Lampronia rubiella*). The life-history of the insect and a clear description of it are given, together with remedies against its depredations. The illustration that accompanies this account is that of the Wood Wasp, inserted by mistake. The correct illustration of the Raspberry Stem-bud Moth and Caterpillar is given in No. 2,494, p. 587.—*W. G.*

Refrigeration, Influence of, on the Fruit Industry. By William A. Taylor (*U.S.A. Dep. Agr.* 1900, p. 561).—An interesting article on the advantage of refrigeration in the storing and transit by rail and export of fruit.—*C. W. D.*

Rhododendron ciliicalyx, Franch. By Sir J. D. Hooker (*Bot. Mag.* tab. 7782).—Nat. ord. *Ericaceæ*; tribe *Rhodoreæ*. Native of China; closely allied to the Indian *R. formosum*, Wall. It is a nearly glabrous shrub; leaves coriaceous, 3–4 inches long; flowers large, white, 4 inches across, the calyx being strongly ciliated.—*G. H.*

Rhododendrons, Evergreen. By W. J. Bean (*Gard. Mag.* 2,484, p. 354, 8/6/1901).—A descriptive account of the finest varieties and botanical species of European, American, Chinese, and Himalayan Rhododendrons, dealt with in the same thorough way as this writer has done in the case of other hardy trees and shrubs. Illustrations are given of *R. Glennyanum*, *R. kewense*, *R. Fortunei*, and others.—*W. G.*

Rhynchites cupreus, Der Pflaumbohrer. By F. Rebholz (*Die Gart.* p. 97, 19/10/1901).—Garden pest, a beetle which destroys a large number of fruit-buds in fruit-trees. Description and remedies.—*G. R.*

Rice. By W. C. Stubbs (*U.S.A. St. Bd. Louis. Bull.* 61, illustrated).—This bulletin deals in Part I. with the preparation, cultivation, flooding, and harvesting of Rice.

Part II. contains special investigations made by Professor W. R. Dodson on the noxious weeds found in the Rice-fields.

I. Rice was first grown largely in Louisiana, directly after the war, on the abandoned sugar plantations.

All Louisiana (both the prairie and alluvial lands) is suitable to the cultivation of Rice, lending itself readily to irrigation, both from rivers and canals, and from artesian wells.

There are three chief varieties of Rice amidst many others, viz. Carolina, Honduras, and Japanese. The latter stands milling better than the two former.

The cultivation is different in the alluvial sections from that followed on the prairies.

The adoption of suitable fertilisers and a system of rotation are recommended.

II. Bad weeds that infest the Rice-fields are as follows:—

Red Rice, Large Indigo (*Sesbania macrocarpa*), Curly Indigo (*Æschynomene virginica*), Tadpole-grass (*Rhynchospora corniculata*), Bull-grass (*Panicum agrostidiforme*), Smartweeds (*Polygonum*), Turtle-back (*Diodia teres*), Bird's-eye (*Scleria*—several species), Morning Glory (*Ipomœa tamnifolia*), Water-grass (*Paspalum fluitans*), Moss-weeds . . . besides other miscellaneous weeds.—*C. H. C.*

Robinia, Disease on. By Hermann von Schrenk (*Rep. Miss. Bot. Gard.* vol. xii. p. 21, 1901). Plates 1–3.—Description of the attack of *Polyporus rimosus* on the Black Locust, or False Acacia.—*G. S. B.*

Rodgersia æsculifolia, Bat. By Baccarini Pasquale (*Bull. R. Soc. Tosc. Ort.* 6, June, 1901, p. 172).—Genus founded by Asa Gray at the expense of the older *Astilbe* of Hamilton, thus separating the forms having carpels fused below, and with digitate and not tripartite leaves. This species was first discovered by P. David, in Mu-pin in Japan, in the year 1869, but was not described until 1898, and by Batalin. It has since been found in various regions of China, amongst others in Si-Ku-Tzui, at an altitude of 800 to 1,200 metres above sea-level.

It flowers in its native habitats from May to July, and fruits in August. The leaves resemble those of the Indian Chestnut, being broad, peltate, palmatifid, with cylindric petiole; the leaflets are obovate, acute or rounded at the apex, glabrous; the principal veins of the lower surface are rough with patent hairs, the margin is either simply dentate or doubly serrate. The inflorescence consists of an elegant panicle, conical in shape and about a foot in length.

The flowers are minute and not excessively densely packed; the calyx is shortly turbinate, five-lobed, the sepals white, flushed with rose towards the tip, and covered on the lower surface with minute hairs. The ten stamens are as long as the calyx-lobes, with yellow globular anthers; the two carpels are also white at the time of flowering.

After fertilisation the calyx turns green and the stamens become erect without falling apart, the filaments only turning brown.

The whole plant has both a bizarre and elegant appearance, and as it is hardy and easy of cultivation, it is certainly worthy a place in the ornamental garden.—*W. C. W.*

Root-galls due to Nematode Worm. By G. F. Atkinson (*U.S.A. Exp. Stn. Auburn, Ala., Dec.* 1889, *Bull.* 9, with 6 plates).—A report upon this common injury, with a description of the external and microscopic characters of the disease, an account of the development and metamorphoses of the worm, a description of the structural alterations caused in diseased roots, the means of eradicating the pest, and a list of thirty-six plants liable to its attacks.—*F. J. C.*

Rose Border, An Ideal (*Gard. Mag.* 2,814, p. 353, 8/6/1901). The writer advocates the planting of Roses in masses of distinct colours, and enumerates a selection of varieties that harmonise or contrast in colour. If the suggestions are carried out, a beautiful Rose border would doubtless result.—*W. G.*

Rose 'Climbing Clothilde Soupert' (*Amer. Gard.* xxii. p. 587; 24/8/1901).—A sport from 'Clothilde Soupert,' originating in 1896 with Messrs. P. J. Berckmans Co., of Augusta, Ga. Colour white, with rose centre, perpetual bloomer, with rapid willowy growth, foliage same as 'Clothilde Soupert.' Registered by the Society of American Florists.

C. C. H.

Rose Cuttings, Different Modes of Taking. By Viviand Morel (*Rev. Hort.* pp. 357–360; August 1901).—An interesting article, giving full details.—*C. T. D.*

Rose 'Gainsborough' (*Amer. Gard.* xxii. p. 414, 8/6/1901).—A new climbing Rose, registered by the Society of American Florists. It is a sport from 'Viscountess Folkestone' and is identical with that variety, except that it is a vigorous climber. It originated with Messrs. Good & Reese, of Springfield, O.—*C. C. H.*

Rose Garden, New Style of. By W. Goldring (*Gard. Mag.* 2,488, p. 421, 6/7/1901).—The writer advocates the formation of special gardens for the Rambling and Trailing varieties, of which there are now so many in cultivation. He describes how to plant the Roses for picturesque effect, and gives a list of the best for the purpose, with directions how and when to plant. Illustrations are given of some views in the Rambling Rose Garden at Kew.—*W. G.*

Rose 'Newport Rambler' (*Amer. Gard.* xxii. p. 510, 20/7/1901).—A new rambler registered by the Society of American Florists. Raised by Mr. R. Gardner of Newport, R.I., out of 'Wichuriana' by pollen of 'Crimson Rambler.' Colour pink, with the fragrance of the seed parent; flower very double, with reflexed petals.—*C. C. H.*

Rose 'Philadelphia' (*Amer. Gard.* xxii. p. 632; 14/9/1901).—A new Rambler Rose registered by the Society of American Florists, raised by Messrs. Conard & Jones, West Grove, Pa., from 'Crimson Rambler,' crossed with the H.P. 'Victor Hugo.' Colour intense crimson, perfectly double, strong grower, with bright foliage.—*C. C. H.*

Rose 'Queen Victoria' (*Amer. Gard.* xxii. p. 632; 14/9/1901).—A new Rose registered by the Society of American Florists. A sport from 'Belle Siebrecht.' Flower cup-shaped; colour coppery yellow, suffused pink; foliage similar to parent, but more vigorous. Introduced by Messrs. Good & Reese, Springfield, O.—*C. C. H.*

Rosen-Neuheiten eines deutschen Liebhabers. By W. Hinner (*Die Gart.* p. 1; 5/10/1901).—Descriptions of new Roses.

'Jacobs Perle,' resembling 'Kaïserin Augusta Victoria,' but more bushy and vigorous, extraordinarily floriferous.

'Max Hesdörffer,' resembling the well-known Rose 'La France,' of same habit and colouring, but darker, while the flowers open more readily.

'Ruhm der Gartenwelt,' similar to 'American Beauty.' This variety is figured on p. 8 of *Die Gart.*

'Marianne Pfitzer,' also a product of 'Kaiserin Augusta Victoria,' resembling 'Malmaison,' but rose-tinted. With fig. on p. 2 of *Die Gart.*—*G. R.*

Roses by the Sea. By H. B. Biron (*Gard. Mag.* 2,488, p. 425, 6/7/1901).—A useful article on the best varieties of Roses that succeed in seaside localities, with practical hints upon the various ways of sheltering them against wind, which is the chief difficulty in seaside cultivation.—*W. G.*

Roses for Pergola. By E. Molyneux (*Gard. Mag.* 2,491, p. 479, 27/7/1901).—The writer gives a good selection of the most suitable

Roses for growing on pergolas or arbours. The list appears to include all the best varieties, and brief descriptions and cultural notes are given. *W. G.*

Roses, New Climbing. By Ed. André (*Rev. Hort.* pp. 375–377; August 1901.)—Detailed descriptions of 'Elisa Robichon,' 'Adelaide Moullé,' 'François Poisson,' 'Alexandre Trémouillet,' 'Edmond Proust,' 'Ferdinand Roussel,' 'Valentin Beaulieu,' 'Emile Fortépaule,' and 'Cramoisi Simple,' all raised by Barbier of Orleans.—*C. T. D.*

Roses, Pillar. By G. Gordon (*Gard. Mag.* 2,488, p. 127, 6/7/1901). —An interesting account of the culture of Pillar Roses at Downside, Leatherhead, together with practical cultural notes by the owner (Mr. Tate), who also gives a selection of the best ones for growing on pillars, posts, and arbours.—*W. G.*

Roses, Tea, for Bedding. By E. A. Merryweather (*Gard. Mag.* 2,488, p. 130, 6/7/1901). —A valuable article from a practical rosarian on the best Tea Roses for growing in masses for colour effect. The observations are made upon culture in a cold Midland locality.—*W. G.*

Rose 'Zéphirine Drouhin.' By S. Mottet (*Rev. Hort.* pp. 356–357; August 1901). A Bourbon hybrid of climbing habits, without thorns. Hardy and robust grower; large double flowers in clusters, deep satin-pink, recalling 'Reine Marie-Henriette,' but paler; very free, flowering and perpetual. Highly recommended. —*C. T. D.*

Sabal Uresana. By William Trelease (*Rep. Miss. Bot. Gard.* vol. xii. p. 79, 1901). Plates 35–7.—Description of a new species of Palmetto from Sonora, Mexico, on the Pacific slope, allied to *S. mexicana*, and discovered by the writer in 1900, but possibly already in cultivation. Its glaucous foliage and edible baccate fruits, with only one of the three carpels fertile, are figured.—*G. S. B.*

Sagittaria Eatoni. By Jared G. Smith (*Rep. Miss. Bot. Gard.* vol. xi. p. 150; 1900; plate 58).—Description of a new species, allied to *S. teres*, collected by Alvah A. Eaton, on sandy beaches of the Merrimac, above the influence of sea-water.—*G. S. B.*

Sagittaria japonica (*Gard. Chron.* No. 766, p. 170, fig. 54, 31/8/1901). A plant very similar to our common Arrow-head, but with larger and very double flowers. If, as is probable, it is quite hardy, it will prove a valuable addition to the water-garden.—*G. S. S.*

Scale, Crude Petroleum *versus* the San José or Pernicious. John B. Smith (*New Jersey Agr. Exp. St. Bull.* 146, pp. 1–20, Nov. 1900).—The author claims that the application of crude petroleum of a certain specific gravity and of uniform quality proved a most effectual remedy for this pest, and was not injurious to the trees when dormant. On the other hand, certain crude oils of heavy specific gravity were destructive to the trees. The observations were made on several thousands of acres of trees of all varieties.—*R. N.*

Scale Insect, The St. José. By J. M. Southwick (*U.S.A. St. Bd. Agr. Rhode Is. Bull.* Sept. 7, 1900, pp. 1-6).—This little pamphlet gives a description, the life-history, and the best means of keeping this insect in check. The scientific name of the San José Scale is *Aspidiotus perniciosus*.—*G. S. S.*

Scale Insects, Lime Mixtures for the Eradication of. Anon. (*Jour. Bd. Agr.* vol. viii. No. 1, pp. 53 54, June 1901).—A note on the experiments with limewater, or whitewash, as conducted in Canada in 1899 against the Oyster-shell Bark-louse (*Mytilaspis pomorum*). Two sprayings in autumn with a mixture of 1 lb. of lime to 1 gallon of water gave satisfactory results. This pest is known in England as the "Mussel Scale," and the mixture might be applied in this country with the same results.- *R. N.*

Scale, The Pernicious or San José. John B. Smith (*New Jersey Agr. Exp. St. Bull.* 116, figs. 1 3, Sept. 1896).--The history of the appearance of this destructive coccid is given, and the life-history briefly stated. Four formulæ are given, in which lime and sulphur form the chief ingredients. -*R. N.*

Scales, Common Orchard. John B. Smith (*New Jersey Agr. Exp. St. Bull.* 140, pp. 1 16, figs. 1-8, Oct. 1899).—Details are given of the Mussel Scale (*Mytilaspis pomorum*), the "Harris Louse" (*Chionapsis furfurus*), and the San José Scale (*Aspidiotus perniciosus*).—"The weak point in the life-history of these scales is in the unprotected larval stage, in which they succumb easily to even weak insecticides. A 10 per cent. mechanical mixture of kerosene (paraffin) and water, kerosene emulsion, 1 to 12, or whale-oil soap, 1 pound in 4 gallons of water, may be successfully used, and, as all the eggs hatch about the same time, one thorough application made while the larvæ are crawling will so clear a tree as to make it safe for two or three years at least. That is easy."
R. N.

Scapania Massalongi. By Karl Muller (Freiburg i. B.) (*Beih. Bot. Cent.* bd. 11, ht. 1; pp. 1 5 with plate). A description and discussion of the affinities of a new Liverwort *Scapania Massalongi*, C. Müll. Frib., from Italy, which is intermediate between *S. carintiaca* and *S. apiculata*. The plant was found by C. Massalongo, "Revolto ad ligna emarcida Pinipiceæ prov. Verona," September 23, 1878, and August 19, 1879. The plate is excellent.— *G. F. S.-E.*

Schizanthus Wisetonensis. By Ch. Pynaert (*Rev. Hort. Belge*, t. xxvii. p. 169 (Col. pl.), No. 8, August 1901).—Introduced to Belgium by Messrs. Hugh Low, of London. It appears to have created a sensation as an "excellent acquisition." A full description is given of the plant, which has white flowers, shaded with pink and orange.

Schomburgkia Thomsoniana. By R. A. Rolfe (*Orch. Rev.* p. 325, Nov. 1901).—A most interesting article, giving the history of this rare species.—*H. J. C.*

Schomburgkia tibicinis, Batem. By O. Massias (*Die Gart.* p. 9; 5/9/1901).—Description and cultural notes as well as history.—*G. R.*

Scilla campanulata 'Rose Queen' (*Rev. Hort.* p. 347; August 1901).—Raised by E. Krelage & Son, Haarlem. Bulbs produce five to eight floral spikes, bearing eight to twenty-five pendulous flowers, bright pink, tinged with lilac.—*C. T. D.*

Scots Pine, Leaf Disease of Young Trees. By C. von Tubeuf (*Gartenflora*, p. 395; 1/8/1901).—One of the most dangerous diseases of young Scots Pines, is caused by the fungus *Lophodermium Pinastri*, whose structure is described. The fungus attacks the leaves, producing brownish spots upon them; they soon dry up and fall off. In bad cases the trees die, and strong plants may be very much weakened by similar destruction of the assimilating organs. The disease is best fought by spraying the trees with Bordeaux mixture between the middle of July and the end of August.—*J. P.*

Selaginella apus and S. rupestris: Study of the Sporangia and Gametophytes. By Florence M. Lyon (*Bot. Gaz.* vol. xxxii. p. 124; No. 2, plates v.-ix.).—Author treats of the origin and development of sporangia, megaspores, female of gametophyte, archegonia, fertilisation, microspores, &c.—*G. H.*

Selaginella, Sporangien, Sporenverbreitung und Blüthenbildung bei. Archegoniaten-Studien IX. By K. Goebel (*Flora*, vol. lxxxviii. Pt. 2, p. 207-228; March 1901).—The expulsion and active scattering of the spores are described and explained, the megaspores being projected to the greater distance. The "flowers" (spikes) are moreover proterogynous and scatter the spores at different times; and in some cases the microspores germinate and form sperms too early to fertilise the archegonia of megaspores of the same "flower." The "flowers" also are studied in the morphological relation of their bracts to the phyllotaxy of the basal vegetative part of the stem.—*M. H.*

Selandria (*Eriocampa*) **adumbrata,** Klug, syn. *Tenthredo*, Ord. *Tenthredinidæ.* By H. Wolanke (*Die Gart.* p. 584; 7/9/1901).—A garden pest doing great damage as larvæ to fruit-trees, principally to Cherry, Pear, Apple, and Apricot trees, feeding on and destroying the leaves so as to almost denude the trees. Appeared in great numbers in the South of Germany during the past summer.—*G. R.*

Sequoia sempervirens, Endl. By Prof. G. J. Peirce. "Studies on the Coast Redwood," *Proc. Calif. Acad. Sci.* iii. *Bot.* 2, pp. 83–106, pl. 14, 1901 (*Bot. Gaz.* xxxi. 442; No. 6).—The author treats of the development of suckers in this tree. In the tendency of the suckers to fasciation, he confirms Frank's view that it is in consequence of an excess of food-substance in available form. Albinism of the suckers is not uncommon, differing much from green suckers. The author attributes it to insufficient warmth. If a sucker begins white, it remains so, no matter how favourable the conditions may be for the development of a green

sucker; because it is in unbroken connection with an abundant food supply, so acting like a parasite. Attention is called to the fact that in this case parasitism in habit and structure is developed by the environment in a single generation from a long line of independent plants. It would seem to the author, therefore, that the influence of heredity is less powerful than the power of reaction to certain immediate stimuli. "May not this always be the case? May it not be that what we call heredity is really the response to similar stimuli and combinations of stimuli occurring in orderly succession in the course of nature?"—*G. H.*

Shallot. By L'Ortolano (*Bull. R. Soc. Tosc. Ort.* 8, p. 251; August 1901).—Propagated by means of the smaller bulbs which have been discarded as useless for the table or sale; which bulbs must be planted in soil manured the preceding year, as the plants will not bear fresh manure or moisture. They may be planted in February or March, or in October and November. In July or August, when the foliage has turned yellow, and after having let it dry for some time in the sun, the new bulbs are removed from the soil and placed indoors where the air is neither moist nor cold.—*W. C. W.*

Sibljak-formation, a little known bush-growth of the Balkan region. By L. Adamović (*Engl. Bot. Jahrb.* xxxi. pp. 1–29; 16/8/1900).—The author gives an account of the various types of bush-growth as determined by the principal constituent, and in each case a list of the plants which form the undergrowth.—*A. B. R.*

Simarubaceæ. By F. Jadin (*Ann. Sc. Nat., Botan.* t. xiii., p. 201; 56 figures and one plate; 1901).—The author has investigated 109 of the known 188 species, and gives descriptions of all the genera of this order. Special attention has been given to the internal structure, and, as a result, a rearrangement of the genera is proposed, while two—*Suriana* and *Holacantha*—included by some authors, are excluded from the order. *W. G. S.*

Slugs, Observations on, and on Experiments for the Purpose of Destroying Them (*U.S.A. Exp. Stn. Record*, vol. xii. No. 11, 1901, p. 1,063).—It is noted that an abundance of fresh vegetation and moisture is most favourable for the development of the field slug, *Limax agrestis*. Its distribution is checked considerably where dry conditions prevail. Many experiments with various insecticides were conducted, but it was proved that "white hydro-oxide of calcium in a 1 to 2 per cent. solution in water" was the most destructive agent. It was also concluded that "from eight to nine o'clock p.m." was the most satisfactory time for the remedy to be applied.—*E. F. H.*

Smut: Formalin as a Preventive of Oat Smut. By William Stuart (*U.S.A. Exp. Stn. Purdue Univ. Indiana, Bull.* 87, 1901).—Gives details of experiments proving the efficiency of soaking smutted Oat grains for two hours in a "1 in 60 solution" of formalin (*i.e.* a pint of formalin to sixty pints of water). Comparison is made with the hot-water

treatment, and the author concludes by saying "that formalin is a convenient, efficient, and fairly inexpensive method of treating Oats for the prevention of smut."—*D. H.*

Soil Analysis, On Uniformity in (*U.S.A. Exp. Stn. Record*, vol. xii. No. 10, 1901, p. 905).—Proposed methods of taking sample, drying, sifting, determination of moisture, loss on ignition, nitrogen, carbonate of lime, "total" mineral constituents, available phosphoric acid and potash, and expression of results.—*E. F. H.*

Soil, Retention of Moisture in. "Sugar" (*Agr. Jour. Cape G.H.* vol. xviii. No. 11, pp. 756–759, May 1901).—Tile drainage, deep culture, and manuring are taken into consideration.—*R. N.*

Soils, Investigation of their Physical Properties. By Lyman J. Briggs (*U.S.A. Dep. Agr.* 1900, p. 397).—The object and methods of the investigation are fully explained.—*C. W. D.*

Soils, Lands, and Soil Moisture (*U.S.A. Exp. Stn. Record*, vol. xii. No. 10, 1901, p. 921; tab. 3). The determined average percentage of free, hygroscopic, and total moisture present to a depth of four feet in the various soils of several localities in California during 1898. The necessity of the presence of "free water" to a sufficient depth to be readily available for the roots to take up is indicated. It is demonstrated that the "evil effects" following a period of drought are noticed for some considerable time after rain has fallen, owing to the fact that although the surface of soil is moistened, the under-soil around rootlets may still be too dry to provide a sufficient quantity of water for the plant to thrive: This fact should always be borne in mind by the cultivator when watering plants growing in either pots, beds, or borders.—*E. F. H.*

Soils, Physical Properties of. Anon. (*Agr. Jour. Cape G.H.* vol. xix. No. 3, pp. 141–144, August 1901).—A continuation of former articles. It deals with the relation of the soil to the atmosphere, &c.

R. N.

Solanum Wendlandi. By Louis Vinvincq (*Rev. Hort.* p. 259; June 1901).—Propagation by cuttings.—*C. T. D.*

Sorbus Species, Contributions to a Knowledge of. By E. Koehne (*Gartenflora*, p. 406; 1/8/1901).—Descriptions of *Sorbus pekinensis*, *S. discolor*, *S. matsumurana*, *S. japonica*, *S. sambucifolia*, *S. occidentalis*, *S. Aucuparia* var. *integerrima*, *S. Aucuparia* var. *dulcis*, *S. Aucuparia* var. *rossica*, and *S. præmorsa*.—*J. P.*

Soy Beans, a drought-resisting crop (*U.S.A. Exp. Stn. Kansas Bull.* 92, 1900).—The Soy Bean is recommended to the Kansas farmer because it stands the drought as well as *Sorghum*. The grain is a richer feed than Linseed meal, and the plant enriches the soil. The bulletin is occupied with hints on culture, harvesting, and statistics.—*M. C. C.*

Sphagnum, Use of, for Seed Sowing. By Jules Rudolph (*Rev. Hort.* p. 263; June 1901).—With special reference to Nepenthes, Orchids, Droseras, &c.—*C. T. D.*

Spider, Red. By L. Mangin (*Rev. Hort.* p. 256; June 1901).—Remedies for its destruction and that of other insect pests.—*C. T. D.*

Spiræas, Bush. By W. Goldring (*Gard. Mag.* 2,486, p. 385, 22/6/1901).—A descriptive account of the finest species and varieties of shrubby Spiræas, with notes on their cultivation. An illustration is given of *S. arguta*, the finest of the early white-flowered species.—*W. G.*

Spraying (*U.S.A. Exp. Stn. Cornell Univ.* No. 188; 3/1901).—Gives time at which to spray different plants and trees for various fungoid and insect pests, and formulæ for the making of various spraying solutions.
F. J. C.

Spraying Fruit-trees (*Amer. Gard.* xxii. p. 408, 8/6/1901).—Recent experiments by Professors S. A. Beach and L. H. Bailey tend to prove that spraying fruit-trees in blossom is dangerous to the crop, and if not altogether ruining it, in any case it decreases the yield of fruit. The laboratory experiments showed that even dilute spray mixtures affected the stigmatic surfaces of the flower, preventing the pollen from growing thereon, while in some cases both the pistil and the stamens withered away after being sprayed, thus preventing the formation of fruit.

Spraying with Crude Petroleum (*Amer. Gard.* xxii. p. 584; 24/8/1901).—Experiments recently carried out in Canada by Mr. G. E. Fisher, Provincial Inspector of San José Scale, tend to show that crude petroleum is more effective for spraying purposes than arsenic, and at the same time, if carefully used, does not injure the foliage in the least. The main point is to apply it with a very fine spray nozzle, and to do this Mr. Fisher employed a watchmaker to make one so fine as fifty diameters to the inch: this is much finer than the finest Vermorel nozzle, and proved very satisfactory.—*C. C. H.*

Spruces, "Weeping" (*Gartenflora*, p. 315; figs. 48 and 49; 15/6/1901).—Figures are given of two Spruce trees showing the "weeping" habit. Both are growing in the Harz district. The smaller specimen at a distance looks like a pole clothed with hops. It is about 14 metres high, and measures at the ground-line only ·6 metre in circumference. The branches, which are exceptionally thin, do not bend up at the tips, but droop completely. The larger example is about 23 metres high. Its lower dry branches bend down gradually until parallel with the stem. At a point about 8 metres high from the ground the stem bears living branches which bend outwards, somewhat like the ribs of an umbrella; above these the branches droop completely as in the form previously mentioned.—*J. P.*

Staphylea elegans var. **Hessei,** Zabel. By A. Hesse (*Gartenflora*, p. 322; 15/6/1901).—A beautiful variety of *Staphylea*, with white flowers flushed with rose. Hesse raised it from seeds of *S. colchica* obtained from the Caucasus. Zabel's description of the variety is given. This author considers it a hybrid between *S. colchica* var. *Coulombierii* and *S. pinnata*.—*J. P.*

Stokesia cyanea. By Ad. Van den Heede (*Rev. Hort. Belge*, t. xxvii. p. 220, Oct. 1901).—Nat. ord. *Compositæ*; native of Carolina. It bears large blue flowers 4 inches in diameter. It grows to about 7 or 9 inches high, useful therefore as a window flower. It cannot stand prolonged or severe winters.—*G. H.*

Strawberries, Prolonging the Season of. By G. Wythes (*Gard. Chron.* No. 759, p. 24; 13/7 1901).—An interesting note in which it is pointed out how "the Strawberry season may be extended by growing certain varieties, and in diverse positions."—*G. S. S.*

Streptocarpus Vandeleuri and S. Armitagei. By E. G. Baker and Spencer Le M. Moore (*Journ. Bot.* 464, p. 262; 8/1901).—Descriptions of two new species, near *S. Dunnii*, from the Transvaal.—*G. S. B.*

Strobilanthes gossypinus, T. Anders. By Sir J. D. Hooker (*Bot. Mag.* tab. 7790).—Nat. ord. *Acanthaceæ*; tribe *Ruellieæ*. Native of the Nilghiri Hills. An erect shrub, covered with a fulvous tomentum, flowering once only, when from six to seven years old, and then dying. Flowered at Kew, 1900, from seed sown in 1887. Flowers, with corolla, $\frac{3}{4}$ inch long; tube, ventricose; lobes, pale blue.—*G. H.*

Sugar-cane. By W. C. Stubbs (*U.S.A. St. Bd. Louis. Bull.* 59).—In this bulletin are given the results of ten years' experiments in field and laboratory, undertaken with a view to improving the cultivation of the Sugar-cane in Louisiana.

The bulletin treats of:—

(1) *The preparation of the soil,* strongly emphasising the necessity of proper and sufficient drainage, as well as requisite ploughing.

(2) *The kind and quantity of cane to plant.* Experiments have shown that the tops of the cane may be used for seed (instead of reserving the whole cane for this purpose), to the great saving of money and labour.

It has also been proved that the best results are obtained by planting the largest canes, rather than medium and small.

(3) *The proper fertilisation.* It was found that, in applying ammonia and potash as manure, sulphates were the best form. Phosphates were found to increase the tonnage.

Experience and experiments tended to prove that there are no known fertilisers which will increase the sugar content.

(4) *The rational modes of cultivation,* showing that "cultivators" are to be preferred to "ploughs."—*C. H. C.*

Sugar-cane, Cross-fertilisation of. By Prof. d'Albuquerque (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 2, p. 182).—It will interest hybridists to know that in Sugar-canes "the average size of the mother closely governs (with exceptions) the size of the offspring," and the same with regard to colour; but in respect of an increase of sugar no rule can be established, and only repeated trial and selection of the best seedlings can at present be relied on.—*W. W.*

Sugar-cane, Manures for. By Prof. Harrison and G. S. Jenman

(*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 2, p. 159).—In an exceedingly able paper details are given of the effect and comparative value of six varieties of manures.—*W. W.*

Sugar-cane, Moth Borers. By H. Maxwell-Lefroy (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 4, p. 327).—A very important and exhaustive paper, describing the species, with figs. of larvæ and of insects, and giving appropriate remedies. -*W. W.*

Sugar-cane, Pests of. By J. R. Bovell (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 1, p. 33).--The following pests are mentioned, fully described, and preventive treatment advised:—The Moth Borer (*Diatræa saccharalis*); the Rind Fungus (*Trichosphæria sacchari*); the Root Fungus (*Colletotrichum falcatum*); White Blight (probably *Dactylopius calcolariæ*); and Black Blight (a fungus growing on the excretion of *Dilpliax saccharivora*).--*W. W.*

Sugar Industry of West Indies (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 1, p. 11).—Dr. Morris, C.M.G., points out that if the West Indies are to see a satisfactory revival of this industry they must not only set to work more energetically, but must begin by discovering the best and raising new varieties of Sugar-cane, and instances that after a five years' trial a seedling cane, called 'B 147,' yielded 7,190 lb. of available sugar per acre, against 6,137 lb. obtainable from 'Caledonian Queen,' and 5,210 lb. from 'Bourbon,' the ordinarily cultivated varieties. Another direction in which improvement may be made is in the crushing machine, there being an average of 2,000 lb. of sugar left in the canes after crushing by the existing machines. At present it takes 13 tons of cane to yield 1 ton of sugar, whereas with better machines 9 tons would suffice. There is also terrible waste in the boiling, for juice containing fully 100 lb. of crystallisable sugar by the present methods of boiling only produces 75 lb.—*W. W.*

Sulphate of Copper, The germination of grains of Wheat treated with. By M. Demoussy (*Ann. Ag.* p. 257; June 25, 1901).—The sulphate of copper is shown to be entirely on the surface, and does not penetrate the grain at all. When sown the moisture in the ground around the grain withdraws, absorbs, and dilutes the small amount of copper on the grain, and the little rootlets are not injured.—*C. H. H.*

Syringa pubescens (Turcz.) (*Rev. Hort.* p. 251; June 1901).—Native of China, introduced by Dr. Bretschneider 1879, but little known. Flowers about a fortnight earlier than most forms; peculiarly variable in form and colour of inflorescence. Owing to precocity, requires shelter from late frosts.—*C. T. D.*

Taphrina Johansoni, Sad., Studien über d. Sporenbildung bei. By S. Ikeno (*Flora*, vol. lxxxviii. Pt. 2, pp. 229–237; t. xiii.; March 1901).—*Taphrina*, belonging to the *Exoasceæ*, causes deformation of the carpels of the Aspen Poplar. The cytology of the formation of the ascospores is studied by modern methods, and offers some interesting

peculiarities, recalling that of *Ascoidea*, as described by Popta. He regards the *Exoasceæ* as primitive Ascomycetes, but as in no sense offering a transition to Phycomycetes.—*M. H.*

Taxodium distichum, Disease of. By Hermann von Schrenk (*Rep. Miss. Bot. Gard.* vol. xi. p. 23; 1900; plates, 1, 3–6).—Historical, mycological, and chemical description of a disease known as "peckiness," caused by an undetermined fungus mycelium.—*G. S. B.*

Taxus. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 7, p. 216; July and August 1901).—A very interesting article, giving almost every kind of information about the Yew tribe, and more especially the common form *Taxus baccata*.—*W. C. W.*

Teaching in Schools (*Jour. Imp. Dep. Agr. W.I.* vol. i. No. 3).—Papers on Education in Agri-horticulture almost fill No. 3 of vol. i. They are very valuable and should be consulted by everyone interested in the problem of how best to introduce the teaching of either agri- or horticulture into our elementary and higher-grade schools.—*W. W.*

Tea Plants. By W. C. Stubbs (*U.S.A. St. Bd. Louis. 18th Ann. Rep.* 1900).—The Audubon Experiment Station is growing, with the co-operation of the U.S. Dept. of Agr., over six hundred Tea plants, with a view of testing practically the raising and curing of the leaves, which industry has been very successful in South Carolina.—*C. H. C.*

Texas, Ecological Relations of the Vegetation of Western. By W. L. Bray (*Bot. Gaz.* vol. xxxii. p. 99; No. 2; 24 text figs.).—The author maps Texas into several regions; mentions plants characteristic of various climatic conditions. An account is also given of the physiography and geology as bearing upon plant-life.—*G. H.*

Thrinax Morrisii. By D. Morris (*Bull. Bot. Dep. Jam.*, vol. viii. p. 82).—Native of Anguilla. A dwarf Palm growing on broken limestone rocks. It was present in fairly large quantities, and the fan-shaped leaves were used for thatching native huts. The largest and apparently the most matured specimen did not measure more than about 30 to 35 inches in height, and the stem was about 2½ inches in diameter. A plant in the Botanic Garden at Grenada is nearly 5 feet in height. The original plants have been nearly all destroyed in Anguilla.—*G. H.*

Thyrsacanthus rutilans. By Ch. Chevalier (*Rev. Hort. Belge*, t. xxvii. p. 199; September 1901; cf. t. xv. p. 14).—Nat. ord. *Acanthaceæ*. A native of New Grenada; it is described and strongly recommended for cultivation.—*G. H.*

Tilia dasystyla (*T. euchlora*). By H. D. W. (*Rev. Hort. Belge*, t. xxvii. p. 203, September 1901).—A native of the Crimea and Transcaucasia. This Lime-tree is remarkable for preserving its shiny and dark-green leaves far into the season. The trunk is smooth, of a grey-

brown colour. It differs but little botanically from *T. parvifolia*, and is much used in public places in Germany in conjunction with *Acacia Bessoniana*.—*G. H.*

Tobacco. By W. C. Stubbs (*U.S.A. St. Bd. Louis. 18th Ann. Rep.* 1900).—Experiments were made at Baton Rouge Experiment Station in the production of "wrappers" from Havana and Sumatra seed, but the soil of the station appeared to be rather too heavy for the best results, that of North Louisiana promising better.—*C. H. C.*

Tomatos on Trellis. By "Fruit-grower" (*Agr. Jour. Cape G.H.* vol. xviii. No. 11, pp. 784–785, May 1901).—The training of the plants on a trellis-work of stakes is claimed to have given good results.—*R. N.*

Trees, North American, New or Little Known. By Ch. S. Sargent (*Bot. Gaz.* vol. xxxi. p. 1; No. 1).—The following are described, with localities:—*Gleditschia texana*, n. sp.; *Cratægus Engelmanni*, n. sp.; *C. Canbyi*, n. sp.; *C. Peoriensis*, n. sp.; *C. pratensis*, n. sp.; *C. submollis*, n. sp.; *C. dilatata*, n. sp.; *C. Holmesiana*, Ashe; *C. coccinea*, L.; *C. c. rotundifolia*; *C. Jonesæ*, n. sp.—*G. H.*

Tropæolum "Isola Bella." By F. Rehnelt, Giessen (*Die Gart.* p. 37, 26/10/1901).—Description and illustration. Produced by crossing *Tropæolum peregrinum* and *T. Lobbianum*. Recommended as profuse winter bloomer, and the bright scarlet flowers are a desirable article for bouquets &c.—*G. R.*

Truck Farming and Trucking. By F. S. Earle (*U.S.A. Dep. Agr.* 1900, p. 437).—This differs from market gardening in that the produce is grown for shipment to a distant market, and is market gardening on a large scale. A few pages are given explaining how it may be profitably carried on.—*C. W. D.*

Vanilla (*Bull. Bot. Dep. Jam.* vol. viii. p. 86).—An account of the cultivation of this Orchid in Seychelles; the value of the "vines"; methods of propagation by cuttings, and of artificial pollination.—*G. H.*

Vegetables, Testing Commercial Varieties. By W. W. Tracy (*U.S.A. Dep. Agr.* 1900, p. 548).—Details are given of the methods pursued by the U.S.A. Dep. Agr.—*C. W. D.*

Vernonia Arechavaletæ. By Edouard André (*Rev. Hort.* pp. 284, 285; with coloured plate).—South America. Pretty lilac-coloured flowers in corymbs. Not hardy.—*C. T. D.*

Vine-culture. Trenching and subsoiling American Vines (*Dep. Agr. Vict.* 1901). By Raymond Dubois and W. P. Wilkinson.—Treatise on the culture of American Vines in Australia, mostly translated from European authorities, profusely illustrated with woodcuts of machinery and appliances. Another pamphlet of same date treats of new methods of grafting and budding as applied to reconstitution with American Vines, chiefly derived from French authorities on the subject. Illustrated by numerous woodcuts.—*M. C. C.*

Vine Disease. Action du Botrytis cinerea sur les greffes-boutures. By M. F. Guéguen (*Bull. Soc. Myc. Fr.* tom. xvii. fasc. iii. 1901).—Sclerotia formed in the sarments of Vine, produced as conidia *Botrytis cinerea*, but the *Peziza* not yet seen. Previously noted by P. Viala in *Rev. Gen. de Bot.* iii. 1891, p. 144.—*M. C. C.*

Vine of Auchmore. By C. W. (*Journ. of Hort.* p. 174 ; 22/8/1901).—An account is given of a famous giant Vine in Perthshire.—*C. W. D.*

Vine, what to Grow, and how to Grow it (*Qu. Agri. Journ.* ix. pt. 2, August 1901).—E. H. Rainford gives instruction for the selection of Vines, and their cultivation in Queensland.—*M. C. C.*

Violets, Wild, of Virginia. By D. Dandridge (*Gard.* p. 94, 10/8/1901).—Giving soil and situations under which the various kinds are found growing in their native habitats.— *H. J. C.*

Violets in Sterilised Soil (*U.S.A. Exp. St. Hatch*, Reports 12–13, 1900–1).—Experiments have been made to determine the production of flowers, and the occurrence of leaf-spots in sterilised soil. The sterilised plats gave the smallest number of leaf-spots.—*M. C. C.*

Violets, Tree. By S. Mottet (*Rev. Hort.* p. 268 ; June 1901 ; with woodcut).—How developed, and species susceptible of treatment.
C. T. D.

Water Garden. By W. J. Townsend (*Gard.* p. 193, 21/9/1901).—Giving particulars as to construction of ponds and a lengthy selection of the best Nymphæas and other plants suitable for water gardening.
H. J. C.

Water-plants in Relation to the Solid Substratum. (*U.S.A. Exp. Stn. Record*, vol. xiii. No. 2, 1901, p. 110).—It was found that by providing rooting material for aquatic plants their growth and "dry weight" were increased over those which were floating and suspended only, or growing in sand alone. In the latter case nitrogen, phosphoric acid, and potash were lacking, and lime, starch, and magnesium were present in excess.—*E. F. H.*

Weather and Plant Life (*Gard. Chron.* No. 758, p. 9, 6/7/1901).—From a recently-published report by the United States Weather Bureau it appears that the temperature of the air has little to do with the duration of time which elapses between sowing and ripening. Effective sunshine is the productive element, which is too often wanting in this country.
G. S. S.

Winter Moth and Mottled Umber Moth. By G. S. Saunders (*Gard.* p. 180, 14/9/1901 ; figs.).—The season to take precautions, and the best means of destroying these pests, are plainly set forth, and should be useful information to all interested in fruit-culture.—*H. J. C.*

Woods of Surrey and Sussex. By J. Simpson (*Gard. Chron.* No. 761, p. 65, 27/7/1901).—A long article on the manner in which

timber is grown in these counties. The system mostly in vogue of growing underwood, which is periodically cut, is condemned as ruining the Oak-trees, which, it is asserted, do not grow to the size they should on account of the stems being subjected to alternate periods of shelter and exposure, which is detrimental to their proper growth, and the trees are in consequence stunted, and of little value, being not worth more than two pounds apiece.—*G. S. S.*

Worms, Nematode. By George E. Stone and Ralph E. Smith (*Hatch Exp. St. Mass. Agr. Col. Bull.* No. 55, pp. 1–67; plates 1–12).—An exhaustive treatise on these destructive eel-worms. The authors have "aimed to give simply a clear and concise description of the nature of nematode worms and their relation to greenhouse plants, together with what they have been able to learn concerning means and methods for their suppression." The species dealt with was identified as *Heterodera radicola*, which is equally destructive in this country. A list of the food-plants is given, which include the *Gramineæ*, *Leguminosæ*, and *Compositæ* out of doors, and under glass the Cucumber, Tomato, Violet, Cyclamen, &c. In summarising the treatment by chemicals, the authors state: "Our own experiments, which were very exhaustive, have convinced us that the application of chemical substances to the soil is of little practical value in ridding it of nematodes." "The desiccation method" consists of drying the soil. Vanha, who discovered the process, applies lime at the rate of 2–4 tons per acre for outdoor treatment. The authors also found that "drying small masses of soil in the greenhouse for a number of weeks completely rids the soil of nematodes."

Cucumbers and other plants cultivated under glass in this country are often seriously injured by nematode or eel-worms, which are frequently introduced in the turf used in the cultivation of such plants. By subjecting the material to great heat, such as the top of a heating apparatus, a safe means of prevention could be thus obtained. Houses once infested with nematodes should be thoroughly cleaned out (removing all soil), dried, and lime-washed before re-establishing fresh plants. (See also "Nematode.")
R. N.

Xysmalobium Schumannianum. By Spencer Le M. Moore (*Journ. Bot.* 464, p. 259; 8/1901).—Description of a new species from British East Africa.—*G. S. B.*

Zaghouania Phillyreæ, Champignon Algéro-Tunisien, par N. Patouillard (*Bull. Soc. Myc. Fr.* tom. xvii. fasc. iii. 1901, with pl.).—New genus and species of Uredine on *Phillyrea media*. Teleutospores four-septate, subcylindrical; allied to *Coleosporium*.—*M. C. C.*

COMMONPLACE NOTES.

By the SECRETARY and SUPERINTENDENT.

MEALY BUG IN A VINERY.

How common and how vexing is such a cry as this:—"My vines are suffering from mealy bug . . . the damage is increasing . . . the crop is good . . . I am afraid to fumigate for fear of spoiling the Muscats . . . my man goes over the vines and dabs methylated spirit with a paint-brush on the bugs wherever he can see them . . . it is all very unsatisfactory." And so no doubt it is; but very little beyond what is being done can be advised until the fruit has all been cut and the foliage has fallen. The fallen leaves, by the way, should be picked up daily and promptly burnt. Beyond this there is only—patience. As soon, however, as the vines are thoroughly at rest, the time of patience ends, and the season of action should commence. The vines should at once be pruned and all the loose bark removed and burnt, of course destroying all the insects met with. Then the vine rods should have a thorough scrubbing with a mixture of Calvert's carbolic soft soap or with Gishurt's compound—four ounces of either to a gallon of water—and if it be used warm it will be all the more effective. After this the woodwork of the house should all be well washed and painted over with paraffin, taking great care that no little hidden corner is omitted. No paraffin should on any account be put on the vine rods themselves. The walls should at the same time be washed with soap and water. All these details finished, the surface soil of the inside border should be carefully removed and replaced with fresh and uncontaminated compost. Then just before the vines are started into growth next year repeat the scrubbing of the rods with one of the insecticides named. If these directions be followed and the work done thoroughly, very little, if any, mealy bug will be found next year, and if a little should appear it must be promptly killed with paint-brush and methylated spirit until the very last bug has paid the penalty. It is very important that no plants with mealy bug be put into the vinery, or the previous love's labour will be lost.

THE SWING OF THE PENDULUM.

It was a sad day for gardening when the beauty and merit of a flower or fruit or vegetable was computed by its size and mathematical regularity of form. We think that the revulsion which has certainly begun against the tyranny of these two dicta must have rejoiced the hearts of the twin goddesses, Flora and Pomona. People no longer pin their faith to the biggest Rose or Apple, or to the Dahlia or the Primula, which approaches nearest to an absolutely circular outline. Even in Chrysanthemums the biggest and most globular, though still exciting wonder, receive far less real admiration than the smaller and more graceful varieties which can be grown in bushes and can be cut in sprays. But in the whole realm of Floradom we doubt if a more sudden and complete revulsion was ever

accomplished than with the Cineraria. Only three years ago we were marvelling at—some almost worshipping—the very dwarf, stumpy Cinerarias, with perfectly flat and exactly round flowers, measuring two inches or more across, and now we have at one bound leapt from one extreme to the other, and the tall, graceful, starry-flowered varieties (fig. 235) are all

FIG. 235.—CINERARIA STELLATA. (*Journal of Horticulture.*)

the rage. We are afraid this swing of the pendulum may go too far in the one direction, as it certainly went too far in the other. Without a doubt, light, elegant, and comparatively small flowers are far more beautiful than the stiff and formal, and often huge unnatural ones of a few years ago; but do not let us degenerate, on the other side, into a worship of the flimsy and the ragged. Will Dahlia lovers forgive us if we ask, Are the

very latest developments of Single Pompon Cactus Dahlias really beautiful, or do they not rather merit the two preceding adjectives we used ?

KEEPING APPLES.

It has been suggested to wrap Apples in paper and pack them in barrels in dry sand or peat-moss dust. It is obvious that either would ensure darkness, an even temperature, and a better "lie" than on open shelves, and a much larger quantity could be stored close together. But without stopping to consider the terrible weight of barrels filled up with sand, either it or peat-moss dust would probably dry all the juice up out of the fruit altogether and give it a haggard appearance, make the flesh of it dry and tough, and almost certainly convey to it a strong earthy flavour. Fruit very quickly acquires the taste of anything that has been associated with it. We well remember a grand lot of Apples being practically ruined by being stored in the loft of a shed whose basement was used for Potatos; and for Pears to taste musty from being allowed to lie on damp straw is of the most ordinary experience. No, if you want to keep Apples, pick them carefully, store on open shelves for a fortnight or three weeks, then go carefully over them one by one, taking only the perfectly sound ones, place them in clean boxes lined with stoutish clean scentless paper, making a layer of fruit all over the bottom of the box, packing tight, but without using any force; lay a sheet of paper over the bottom layer, then pack on it a second layer, and a third, and so on till your box is full. Roughly speaking, four layers one upon another are enough, unless the fruits are small. Put on the lid after the last covering of paper and store the boxes in a cool, not over-dry place, where the temperature will not vary much, placing them on the ground; but if it be a brick or earth floor (which is better far than boards), raise them with a half-brick at each corner, so that the bottom of the box does not actually rest upon the ground. A cellar is a good place, or quite the back of a clean coachhouse. The mistake generally made is the keeping Apples and Pears too dry and too much exposed to air. Apples keep magnificently in "clamps" or buried underground, but under such circumstances it must be difficult to avoid their tasting of the earth.

MISTLETOE.

A Fellow tells us that "some years ago Mistletoe was introduced into a garden in Bovey Tracey by rubbing the seeds on to an Apple-tree ; it now covers that tree with large bunches, and has spread all over an adjoining orchard and is growing on several Thorn-trees, and there is one large bunch on a tall Acacia near." We ourselves introduced Mistletoe into a garden in 1884, and have often since wondered if we had not done a very silly trick, noticing that on a tree in which it is once established it appears able to send out fresh bunches without the necessity of fresh seed-germination. It is very interesting to watch the germination of the seeds. Sow them in April or May, and they lie dormant till the following spring, when two bright green "horns" as it were start forth from the seed straight into the air, and you think, "There

are the little upward stems; their points will put forth leaves soon." But wait a little, and you will notice the said points turn right over until they touch the bark of the tree, one on one side of the seed, the other on the other, and in that bent-over, looped attitude they will remain some time, possibly in some cases till the following spring. Then the points which you thought were going to put forth leaves will have put forth roots through the bark, and, penetrating into the tissues of the wood, become the future feeders of the plant. At last the other ends—the bases—of the two "horns" will break away from the now empty seed-case and raise themselves upright and begin to put forth the first pair of little leaves. In one case, which was watched very carefully, the seed remained in its "looped" attitude five years before making up its mind to straighten its back and begin to do its life's work.

Violets for Early Spring.

The Fellow who asks a question on this point is probably not alone in wanting to know how to make up a good bed for the winter, so that the question may be replied to generally. In August, or early in September, a bed of not less than one foot deep of litter should be made, well trodden down—quite firmly. On this the frame or frames should stand. Then place upon the litter six inches deep of loam to which a little leaf-mould has been added, and on this plant the Violets, taking care to arrange matters so that the plants are not more than six or eight inches from the glass. Give a good watering when all the plants are planted, and, if the weather happen to be bright and sunny, syringe them lightly overhead once or twice a day. The frame lights should not be put on at all at first unless it be very wet, and then they should always be well ventilated, not close shut. When the nights get really cold put the lights on, but even then give plenty—*plenty*—of air whenever the weather is favourable. The Violet can stand a good deal of cold, but what it cannot stand is a close, stuffy, muggy atmosphere. It almost lives on air. Judgment must be used in watering. Violets do not at all like to be quite dry, but wet, soaking, loose soil they cannot abide. Therefore water when really necessary, but always do it in the morning when you can keep the lights at least open, so that the foliage may get quite dry before night during the short winter days. Whenever the thermometer is above 35° or 36° they will be all the sturdier for the lights being taken off altogether for a couple of hours in the middle of the day when it is bright and fine. For plants, young ones raised from last spring's runners are greatly to be preferred to old plants; they produce many more flowers and far finer ones.

Monstera deliciosa.

One does not often come across *Monstera deliciosa* grown for its fruit, and personally we do not regret the fact, for it always strikes us as very flat and mawkish. But it is a handsome plant, with its great spreading green leaves on long stalks, at first perforated and later splitting to the edges like a palm; and if it form and ripen fruit it is at least curious, and some may even like its flavour. Of what does it taste? Well, just as colours are not always quite the same to different eyes, so flavours

strike different palates differently; but we should say Monstera tastes of Bananas pounded to a pulp with a little Pineapple juice thrown in. What does the fruit look like? Well, what two people would ever describe a thing in the same way? But we should say Monstera fruits look as if bees had built green-coloured honeycomb all round and all over a fairly long ruler; and it all takes to pieces when ripe—comes into hundreds of small long conical tubes, coming to a point in the centre where they touch the core, and presenting on the outside the appearance of a green hexagon like a bee's honeycomb cell.

A Fellow writes that last year he had a plant which set three fruits, but they did not ripen properly. One was cut, and after lying in the greenhouse for some time it got a little juicy, and one still clings to the plant, having apparently dried up. This year four large blossom spathes have formed, and he wants to know how to treat it. On inquiry, we learn that the aerial roots should be syringed daily twice, as the plant to a very great extent depends on these and not on its base roots for moisture. Soot-water and other fertilisers should be given occasionally. But the greatest care should be taken not to wet the fruit itself more than can be helped, as it quickly decays at the stalk if this be done. Indeed, the fruits will decay before they are half grown if the house is close and damp, or cold. Being a native of the West Indies and tropical America, it likes an intermediate house temperature or even warmer not below 50 to 55 deg. in winter and 60 to 70 deg. in summer. The fruit is formed in summer or early autumn, and ripens in the spring.

Banana Disease.

A report was received from a correspondent in Egypt that a disastrous disease had broken out in a plantation of Bananas, the more extended cultivation of which he was endeavouring to introduce into the lower provinces of the Delta. One of the diseased stems was sent for, but no trace of fungus could be found. The decayed parts were swarming with nematode worms, which are usually regarded as scavengers removing the result of disease, and not as causing it themselves. It is now suggested that the plants are suffering from a disease which is well known in many parts of the world, which generally first shows itself in the crown, on the sheath, or on the leaf. The remedy advised is nitrate of potash, a handful to be sprinkled at a distance of about 18 inches round the stool, and repeated every ten weeks from the time of the plants first beginning to grow.

"What is a 48 Pot?"

Such is the question a Fellow asks of us. And a very difficult one it is to answer, because the pot-makers (and we have consulted three, in a very large way of business, in different parts of England) do not seem to be agreed among themselves. However, we shall endeavour to explain the matter as it appears to us, and if we fall into error perhaps someone with clearer insight will put us right.

At every pot-maker's yard a certain measure of clay is taken and is made into a "cast" or "tally" of pots. Observe, the "certain measure" of clay is the same in each yard, never mind how many or how

few pots it is going to be made into; but, alas! this certain measure, although the same in each maker's yard, varies very considerably in the different makers' yards. That is to say, Mr. Smith takes a certain measure of clay and makes it into, say, forty-eight pots; and Mr. Smith's certain measure being always the same it follows that his forty-eights will always be of the same size. In like manner Mr. Jones does precisely the same with the same results: as far as his own pots are concerned, they are always the same size; but Mr. Jones's "certain measure of clay" is bigger or smaller than Mr. Smith's, and therefore his forty-eights will always be a trifle bigger or smaller (as the case may be) than Mr. Smith's. And the same variation will of course be found, however many or however few pots be made from this "certain measure." For example "a No. 1 pot" (*i.e.* when the whole of the "certain measure of clay" is used up in making only one single big pot)—"a No. 1" in London is 22 inches in diameter, while at Derby it is only 18 inches. "A sixteen" (*i.e.* where the certain measure is made into sixteen pots)—"a sixteen" is 9 inches in diameter in London, 8½ inches in Derby, 8¼ at Hertford, 8 inches in Sussex. "A twenty-four" (*i.e.* when the "certain measure" is made into twenty-four pots)—"a twenty-four" is 7¾ inches in diameter in London, 7½ at Derby, in Hertford 7¼, and in Sussex 7 inches. "A forty-eight" in London is 5 inches in diameter, at Hertford 4¾, and in Sussex 4½.

Another source of confusion is that some makers measure the diameter of a pot from outside to outside; some, from inside to inside; and other some, from outside on one edge to inside on the other.

The outcome of the whole consideration is how vast an improvement it would be if all pot-makers would agree to work to a fixed and given standard, and call the pots by the inside to inside diameter measurement. For example, why not fix our present so-called "forty-eight"—*fix* it at 5 inches inside diameter and call it "a 5-inch" instead of "a forty-eight" Then the next size larger could be "a 5½-inch pot" instead of "a forty" the next size "a 6-inch" instead of "a thirty-two"; the next "a 7-inch' instead of "a twenty-eight," and so on.

The following is a pretty correct list of the names and sizes of pots in the Midland counties, but let no one be so simple as to imagine it holds good in London or the West or North of England; and could anything be more ridiculous?

A "72" .	measures	2	inches	in diameter.
A "large 72"	,,	2½	,,	,,
A "small 60"	,,	2¾	,,	,,
A "60"	,,	3	,,	,,
A "large 60"	,,	3½	,,	,,
A "small 54"	,,	4	,,	,,
A "large 54"	,,	4¼	,,	,,
A "small 48"	,,	4¾	,,	,,
A "48"	,,	5	,,	,,
A "40"	,,	5½	,,	,,
A "32"	,,	6¼	,,	,,
A "28"	,,	7	,,	,,
A "24"	,,	7½	,,	,,
A "16"	,,	8½	,,	,,

A "12"	measures	10	inches in	diameter.
An "8"	,,	11	,,	,,
A "6"	,,	12½	,,	,,
A "4"	,,	14	,,	,,
A "2"	,,	15½	,,	,,
A "1"	,,	18	,,	,,

Then there are "Thumbs" and "Long Toms," and goodness knows what else besides, all going to show how absurd and complicated the present system is.

Peaches and Nectarines.

It is very difficult to get people to understand the peculiar relationship which exists between Peaches and Nectarines—that they are practically one and the same plant. Of course each tree is a different individual specimen or representative, but they are all either continuations or descendants of one and the same plant. If the particular individual has been raised by grafting or budding, it is, of course, simply a continuation of the plant from which the graft or bud was taken; or if it has been raised from seed it is the direct descendant or child of the plant which produced the seed. Now we know that if we sow a Plum-stone a Plum-tree will come up; or if we sow an Apple-pip an Apple-tree will come up and nothing else—better or worse than its parent it may be, just as children generally are—but, a Plum or an Apple for all that, and nothing else. And if anyone were to show us a Pear-tree and tell us he raised it from an Apple-pip, we should *know* he was mistaken—had got his seeds or labels mixed or something; or if we saw a tree bearing both Apples and Pears, we should know it had at some time or other been grafted or budded, because the Apple and the Pear are two absolutely different plants, and the seed of one cannot produce a plant of the other, nor can a graft or bud of the one bear fruit of the other. But Peaches and Nectarines are not thus distinct; they do not stand in at all the same relationship to each other—or want of it—as do Apples and Pears, Plums and Apricots, &c. On the contrary, if you sow the stone of a Peach it is quite likely that the plant which grows up from it may turn out to be a Nectarine; and *vice versa,* if you sow a Nectarine you may as likely as not raise a Peach. But further than this, so intimate is the relationship between them (one may almost say, so identical are they) that a Peach-tree will not infrequently bear a Nectarine in the midst of all its other crop of Peach fruits, and our illustration, Fig. 286, which comes from the *Gardeners' Chronicle,* shows a fruit which was three-quarters Peach and one-quarter Nectarine. Nor was it only an apparent or superficial likeness, for not only was the skin of the three-quarters rough and woolly like a Peach, and the skin of the other quarter smooth and shiny like a Nectarine, but the flesh underneath the two parts partook of the nature of the Peach and Nectarine—that is to say, three-quarters of the fruit were soft-fleshed like a Peach, whilst the other quarter under the Nectarine skin was of the firmer, smoother-textured, and more luscious character which distinguishes the Nectarine. No one, therefore, need be astonished if any of these interchanges between the two fruits should come under his own observation. The raising of Peach-trees from Nectarine

stones, and *vice versa*, is exceedingly common. The occurrence of a Nectarine fruit on a Peach-tree is unusual, though not very rare. The production of a fruit part one, part the other, as represented in Fig. 236, is, as far as we know, unique, but having happened once, it has shown us both the exceedingly close relationship of the two fruits, and also that it may very probably happen some day and somewhere again.

Another point, on which people often mistake, is worth mention. As a general rule, the flesh of a Peach or a Nectarine as grown in England is almost white, perhaps with a few dashes or flushes of crimson, but roughly speaking white. But there are a multitude of varieties which have yellowish flesh, and some of quite an orange colour. In England we think the yellow-fleshed Peaches—which are generally very large fruits—are distinctly lacking in flavour compared with the white-fleshed varieties, and so they are very seldom met with amongst us. But it is not so at all with the yellow-fleshed Nectarines—which are generally smallish

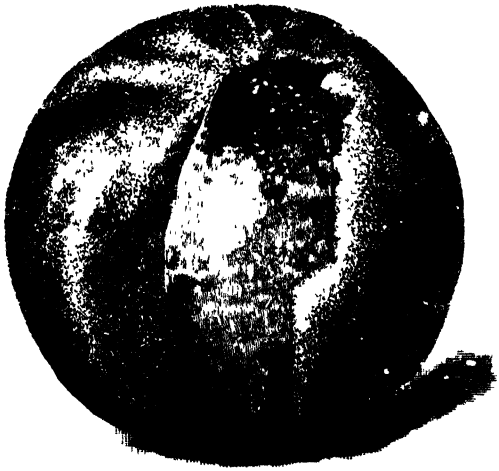


FIG. 236.—FRUIT HALF PEACH, HALF NECTARINE. (*Gardeners' Chronicle.*)

fruits—many of which are of superlative flavour. For instance, 'Goldoni,' a yellow Nectarine, raised from a Peach-stone by the late Mr. Francis Rivers, of Sawbridgeworth, to whom we are indebted for literally *all* the good new varieties of Peaches and Nectarines—'Goldoni,' when properly ripened, is, in our opinion, without any exception the finest fruit in the world. These yellow-fleshed Nectarines are not nearly so much grown as they should be, because, forsooth, they not are quite so large as the white-fleshed. But when they are grown we have not once nor twice but often heard people saying, "Oh, it's a cross between a Nectarine and an Apricot," a statement for which there is not the very smallest foundation, or, indeed, the least probability; in fact, you might just as well say that because a Mango is of fine flavour and yellow, therefore these yellow-fleshed Nectarines are "a cross between a Nectarine and a Mango." We have no idea what it is that produces the yellow hue in some Nectarines; neither have we any knowledge, and very little idea, what produces variation of colour in any tree or plant or fruit; but we need not on that

account manufacture positive statements out of our own futile and often demonstrably erroneous guesses.

TO IDLE FOLK.

By "idle" we only mean "not quite so busy as ourselves." And should this catch the eye of any such, we ask them: Why do you not set to work to hybridise something—to raise some new varieties or some new and improved strain, for the benefit of future generations of garden-lovers? There is a wonderful opening nowadays for anyone who really loves plants. Let them only take up one or at most two genera, and work—aye, *work* at them; turn them and twist them this way and that way; hybridise, cross, select, in all directions, backwards and forwards, and cease not till something good, something well worth having, rewards their labour. And for choice take hardy plants in hand, because the number of people you can benefit with them is so much greater than with glass-house plants. What shall you take? Well, really, everyone must choose for himself; but that you may not say you can think of nothing, we suggest—Why not seek to raise up a whole race of brilliantly-coloured and perfectly hardy Anemones by crossing the common Wood Anemone with *Anemone coronaria*, in all its glorious colours, and also with *Anemone stellata*? True *A. coronaria* and *A. stellata* are both of them hardy in a sense and in some places, but nothing like *A. nemorosa*, the common Windflower of our woods in spring. Think how generations yet unborn would bless you if you could present them with a strain of *nemorosa* with all the colours of *coronaria* and *stellata*, still preserving the lovely form and free-flowering habit of *nemorosa*. And this is but one example; there are abundance of others as easy—or, it may be, as difficult, for till it is tried no one can tell whether such a cross would be easy or difficult; but difficulties should not discourage us—only inspire us to overcome them.

THE BEECH-TREE IN ENGLAND.

At the moment we can only speak positively of the south-east of England, but we should like to receive reports from other parts, for we fear the Beech is doomed all over the country, and that the next generation will only know by pictures and reports how gloriously beautiful our forest Beeches have been.

Of recent years the Beech, in the south-east at least, has fallen a victim to a little insect pest called *Cryptococcus fagi*. To the ordinary eye it presents almost exactly the appearance of the well-known 'American Blight' or 'Woolly Aphis' on Apple-trees. Whence it comes, or how it travels from one tree to another or from one district to another, we do not know. It first fastens on the bark of a healthy tree, and looks only like a little white spot the size of a pin's head, but these spots rapidly increase, and grow generally into long longitudinal groups, and afterwards spread out right and left, until from a single white spot, which it would take a very observant eye to notice, the whole trunk and bigger branches are often so absolutely covered with the insect as to have the appearance of having been whitewashed. The insect sucks all

the juices out of the bark, rendering it quite dry and brittle, so much so that it cracks and at last peels off, and then the death of the tree is at hand. The insect itself may be readily perceived with a small magnifying glass if you first strip off the white woolly substance under which it clusters. It is of a dingy semi-transparent appearance and almost globular. The white woolly stuff is said to be of the nature of wax, and is thrown off from the insect simply as a shelter from the cold in winter and from the heat in summer. We have recently had specimens sent for identification from Sussex, Surrey, Kent, and Essex, in which counties at least we should strongly advise landowners not to plant any Beech, for the pest attacks trees of all ages, young as well as old, and we fear there is no battling with it, as it is so incredibly abundant. If anyone thinks he has not got it in his own immediate neighbourhood, let him carefully examine all the trees about, and then, if he find none, he may indeed rejoice. The insect is described by Mr. Newstead in the Society's JOURNAL, vol. xxiii. p. 249, and the only remedy he can suggest is to scrub the trees hard with soft soap and water and a hard scrubbing-brush—a method possible, perhaps, for one or two trees or so on a lawn, but quite impracticable in park or wood land.

PEACH-LEAF-CURL FUNGUS.

A Fellow, referring to the note on p. 163, vol. xxv., asks, "How much lime should be put to how much water?" The Countess of Selkirk has been kind enough to send us her gardener's (Mr. W. McGuffay) reply:—Take 2 lb. of unslaked lime and put it in 2 gallons of soft water (rainwater is best), cover it up and let it stand for twelve hours. Strain the liquid off through a fine cloth. Take a gallon of this liquid and add to it a lump of soft soap about the size of a walnut which has been well dissolved in half a gallon of warm water. Mix them together and spray the trees thoroughly with a fine spray. Mr. McGuffay has found this very effective. The spraying should, of course, be done early in the day, so as to be dry before night, and should on no account be used when the flowers are in bloom. *See also* p. 569.

BOOKS RECEIVED.

"Flowering Plants, Grasses, and Ferns of Great Britain." By Anne Pratt. Edited and revised by Edward Step, F.L.S. 4 vols. royal 8vo. (Frederick Warne & Co., London.) 48*s*.

Who that is past middle life and verging on the threescore years does not look back and remember the delight in early days of being allowed as a great treat to look at a volume of dear old Anne Pratt, and compare with her truthful illustrations all the little handful of wild flowers culled in the morning's walk? And who that does so look back will not welcome this new edition and order it at once, that dear old Anne may gladden the hearts of the grandchildren as she did ours of yore? There is no book that deals with our native plants so thoroughly and so exhaustively, and in such language "understanded of the people," as our old favourite does, and now that it has been so excellently revised by Mr. Step it positively lacks nothing. The revision has been very reverently done, omitting very little of the old folklore and poetical and other old-world associations which Anne was so pleased to accumulate and cluster round each common plant. For Anne does not proceed upon the lines of picking out all the showy flowers and ignoring those of a less assertive character. These unpretentious plants have many interesting points in their structure and economy; and here they will be found to have been accorded a place ungrudgingly, her object being to render the work complete as well as attractive. Moreover, it is in respect of such plants that the ordinary unscientific person most needs assistance. Coloured figures are given of no fewer than 1,525 species of British plants, and this compels us to confess the only fault we ever found and still must find with Anne: she sometimes puts too many plants on one page of illustration, making it sometimes a wee bit difficult to tell at once which stalk and leaf belong to which flower; but even for this only a little care is needed.

"The Book of Asparagus &c." By Charles Ilott. (John Lane, London.) 2*s*. 6*d*. Crown 8vo.

The first of a series of "Handbooks of Practical Gardening," edited by Harry Roberts. Judging by this first volume of the series, we can congratulate ourselves on the anticipation of a series of thoroughly practical manuals. This first volume deals, and deals excellently well, with the cultivation of Asparagus in all its aspects, from the first consideration of soil and site, through sowing and planting, manuring and forcing, up to cutting and bundling for market. There is a chapter also on diseases and insect pests, as well as one upon cooking, and a very brief notice of the purely decorative varieties of Asparagus. Little more than half of the volume is devoted to Asparagus, the other half being occupied with similarly excellent and practical notices of Seakale, Celery, Celeriac, Salsify, and Scorzonera, and these again are followed by culinary recipes.

"Nature Teaching." By Francis Watts. (Dulau & Co., 37 Soho Square, London.)

In things horticultural the British public is very apt to run after anything that is big, and to look slightingly on things of lesser dimensions. Gladly will the British matron give a sixpence for a huge 'Pitmaston Duchess' pear and grudge a penny for a little 'Thompson' or 'Comte de Lamy.' Well, such folk need not buy this little book, for even for a shilling, which we believe to be its price, it is "no size at all." But if this should meet the eye of anyone who values quality before dimensions let him not hesitate, for this little volume is full from the first page to the last of the most practical teaching of elementary facts relating to plants and plant cultivation we have ever come across. It is issued by the Commissioner for Agriculture of the West Indies, and is intended for the use of elementary schools, and most admirably is it adapted for the purpose. We envy the little West Indians getting such plain and withal such interesting school teaching. In its present form it naturally (in illustrating any principle or fact) takes its example from among the common plants and fruits of the West Indies, but so well is it arranged and planned that any teacher here in England could easily substitute as an example some other plant or fruit well known to his class. An edition of it arranged specially for England would be a real boon to those children who have not a teacher at hand able to suggest suitable substitute examples.

"The Book of the Greenhouse." By J. C. Tallack. (John Lane, London.) 2*s.* 6*d.* Crown 8vo.

This is the second volume of the Practical Handbook Series, and Mr. Tallack's name is guarantee that all has been done that can be done in dealing with so large a subject in so small a compass. To condense all there is to be said about "the Greenhouse," and "the plants to grow in it," and "how to grow them" —to condense it all into 100 pages "passes the wit of man," we think. But Mr. Tallack has made the most of the space at his command, and not a line is wasted on literary effort or on elaborate description; all is used up on thoroughly practical advice and comment and directions; indeed, it is astonishing how much is compressed into these 100 pages. Any amateur wishing to succeed with a little (or for the matter of that, with a big) greenhouse will do well to procure this book. One great and serious defect we must point out—there is no index. This should be the very first point seen to in publishing the second edition, which is sure to be called for ere long.

"Elementary Botany." By Professor Percy Groom (Geo. Bell & Sons, London). 275 illustrations. 3*s.* 6*d.* Crown 8vo.

Professor Groom, from a very wide and long experience as an Examiner in Botany, knows exactly the weak points of students—want of observation, insufficient examination of living plants, frequent confusion in the use of technical terms—the first two arising from too exclusive a book knowledge, and the third from the use of too advanced treatises before the primer of the subject has been learned. He has therefore set himself to write a book which shall in every part and detail stimulate observation

and compel personal examination of the plants discussed, and yet be free as far as it is possible from the too frequent use of technical terms and expressions. A difficult task indeed, but he has fulfilled it almost to the letter. It is a thorough student's book, no twaddle, no imaginary conversations between impossibly good children and inanely omniscient old ladies—a thorough student's book, but expressed in the pleasantest possible way and always with a view to make a distinct call upon the personal observation of the student. Professor Groom's idea was to make his book useless without actual examination of the plants he speaks of, but in this respect we do not think he has entirely succeeded, for the plates and figures are so numerous, so clear, and so life-like, and the letterpress so plain and lucid, that although having the plants actually in hand must be a great advantage, and from all points of view is most desirable, still even without them the book cannot help teaching by itself. It is to be placed on the list of text-books recommended for the use of students preparing for the Society's examinations.

"Lilies for English Gardens." By Gertrude Jekyll. (Geo. Newnes, Limited, London.) 8s. 6*d.* 8vo.

Another of Miss Jekyll's delightsome volumes. It will be welcomed by all garden-lovers, containing as it does the knowledge and experience of all the best English growers, expressed in the pleasantly rippling sentences of this accomplished writer. The book would be worth possessing for the letterpress alone, and *vice versa* for the illustrations only, of which, by the way, there are no fewer than sixty-two, mostly full-page ones, and executed with that perfect clearness so characteristic of all that issues from the *Country Life* press.

"The Book of the Grape." By H. W. Ward. (John Lane, London.) 2s. 6*d.* Crown 8vo.

Excellent advice is given for amateurs on the structure and heating of a vinery, and on the soil to plant the vines in. Methods of raising from eyes and by grafting are explained and illustrated, and the treatment and culture fully gone into. We note with satisfaction that Mr. Ward gives the correct spelling of the well-known grape 'Gros Colmar,' and does not, as nine growers out of ten do, call it 'Gros Colman.' He is also not far from the truth when he describes it as being only "of moderate quality," for it is the poorest in quality of all the grapes ordinarily grown, and has nought but its size and appearance to commend it. Market growers, however, know perfectly well by experience that the great British public prefer size and colour with little or no flavour in fruits, to abundant flavour with less size and colour, as witness the ready sale of Pitmaston and Clairgeau pears and Gros Colmar grapes.

"The Gardener's Assistant." By Robert Thompson. New edition by W. Watson, F.R.H.S. (Gresham Publishing Company, London.) In 6 vols. 8s. each.

Vol. IV., which has lately reached us, is concerned entirely with the Fruit Garden and Orchard, and is replete with excellent advice. There is a very instructive chapter also on the subject of spraying fruit trees,

gathered mostly from American sources, as the subject is still but very little practised in this country, and requires attention at the hands of our orchard and market growers. The illustrations are as good as any illustrations of fruits in black and white can be, which for purposes of identification is not of any great assistance. We are sorry to find 'Pitmaston Duchess' still included in the first select list of "High Quality" Pears. It throws suspicion on its associates, which, by the way, is not wholly misplaced as regards 'Buerré Diel' and 'Beurré Rance.' Again, whether fig. 898 be 'Josephine de Malines' (as we suspect) or not, it certainly is not the true 'Knight's Monarch.' These, however, are small points to notice in a book of such general excellence.

"The Book of Old-Fashioned Flowers." By Harry Roberts. (John Lane, London.) 2*s.* 6*d.* Crown 8vo.

This, the fourth of the Practical Handbook Series, is a distinctly more literary work than its predecessors, though none the less practical. Its predecessors contain vast masses of useful and oft-needed knowledge—so too does this; but they administer it somewhat in the way recipes are given us in cookery books, this in the way of powders in jam or in figs; in fact, one would take up this volume and read a few chapters for sheer pleasure in reading, and learn without being conscious thereof. The others one would only go to when one definitely wanted to learn on some particular point. It is hopeless to attempt to "review" such a book. It wants reading from one end to the other, and we are confident that no one who buys it will ever regret it. Alas! if it had but an index how good it would be! In these hurrysome days indices are no longer luxuries for the idle, but necessaries for the hard-worked.

"Hardy Border Flowers." By Walter Smyth. (William Mullan, Belfast.) 1*s.* 8vo.

A compact little treatise on the making of hardy flower borders and rock gardens, which, if it does not contain anything very new, is at least a useful summary of the old. The lists of flowers observed in bloom in each month of the year is, in our opinion, the best part of this pamphlet, and the addition at the end of blank pages upon which to make one's own notes is a distinctly useful appendage.

REPORT ON GLADIOLUS GROWN AT CHISWICK, 1901.

ALL the corms were received from Messrs. Barr, Covent Garden, and were planted on May 6.

A.M. = Award of Merit.

I.—CHILDSII VARIETIES.

1. Adolphe Close.—Large spike of bold well-expanded pale purple or slaty-blue flowers, suffused with salmon, the basal half of the lower segments mottled with crimson and striped with white down the centre.

2. Africa. Sturdy spike of large dull crimson flowers, suffused with dark purple and striped with white down the centre of each segment, the basal half of the lower segments greenish-white.

3. Aurea superba.—Tall spike of rich orange-scarlet flowers, the lower segments mottled with crimson and white.

4. Bessie Tanner. A very showy variety, producing an unusually large spike of bold salmon-rose flowers, the three lower segments blotched with cream-white.

5. Boston. Rather small spike of scarlet flowers, the basal half of the lower segments speckled with crimson on a white ground.

6. Brilliant. Tall spike of rich orange-scarlet flowers, the basal half of the lower segments speckled and blotched with crimson and carmine.

7. Columbia.—Stout spike of large shapely orange-scarlet flowers, flaked and edged with purple.

8. Dr. Sellow.—Vigorous spike of large shapely bright rosy-carmine flowers, marked with white and crimson in the throat and slightly striped with white down the centre of each segment.

9. Elaborate.—Handsome spike of scarlet flowers, the lower segments blotched with white, streaked and edged with carmine.

10. Falconer's Favourite.—Vigorous spike of bold salmon-red flowers, the lower segments mottled with white and slightly suffused with crimson.

11. Marguerite.—Bold spike of large scarlet flowers, flaked and suffused with purple, the basal half of the lower segments speckled with cream-white and crimson.

12. Mohawk.—Strong spike of large salmon flowers, shaded and streaked with scarlet, the basal portion of the lower segments mottled with crimson and white.

13.—Mrs. Beecher, **A.M.** August 13, 1895.—Sturdy spike of rich scarlet flowers, faintly suffused with carmine and freely speckled with crimson and white in the throat.

14. Princeton.—Tall spike of fiery scarlet flowers, marked with violet and white on the basal portion of the lower segments.

15. Ruby.—Vigorous spike of bright scarlet flowers, with deeper shadings, the lower segments marked with carmine.

16. Senator Childs.—Large scarlet flowers, touched with crimson, blotched and striped with white down the centre of each segment.

17. Splendour.—Large salmon-red flowers, suffused and streaked with carmine and freely mottled with white.

18. Torchlight.—Stout spike of substantial scarlet flowers, suffused with orange, the basal portion of the lower segments netted with orange on a white ground.

19. William Falconer.—Very strong spike of large handsome pink flowers, shaded and feathered with scarlet, the basal portion of middle lower segment mottled with crimson.

II. Gandavensis Varieties.

20. Addison.—Lovely rose-coloured flowers, with deeper shadings, each segment striped with white down the centre, the three lower ones stained with crimson.

21. Angele.—Pale blush flowers stained with rosy crimson in the throat.

22. Chameleon.—Rather small spike of rosy-purple flowers, blotched with cream-white and striped with white down the centre of each segment.

23. Christopher Columbus.—Large carmine flowers, streaked with purple and violet and striped with white down the centre of each segment.

24. Coquête.—Sturdy spike of beautifully-shaped rosy-carmine flowers, with a white throat, the upper segments slightly streaked with pale rose.

25. Crépuscule.—Very stout spike of large light purple flowers, streaked and feathered near the edge of the segments with a lighter shade of the same colour; the basal portion of the middle lower segment is stained with carmine.

26. Eugène Scribe.—Beautiful rose-pink flowers, passing to white near the crimson centre.

27. Feu Follet.—Rather small rosy purple flowers with a light throat.

28. Fra Diavolo.—Pale salmon-pink flowers, blotched with lemon-yellow, and striped with white down the centre of each segment.

29. Horace Vernet.—Sturdy spike of medium-sized scarlet flowers, shaded with purple, blotched with white on the lower segments, and striped with white down the centre of each segment.

30. Lampa.—Beautiful rose-coloured flowers, with a silvery-pink throat; the middle lower segment is creamy-white, streaked with crimson.

31. Leviathan.—Vigorous spike of very large pale purple flowers, streaked with carmine.

32. Madame Poiret.—Very large spike of pale pink flowers, the basal half of the lower segments creamy-white, streaked with purple.

33. Mdlle. Marie Verdalle.—Tall spike of salmon-coloured flowers, flaked and edged with purple, the central portion of the lower segments blotched with cream-white.

34. Matador.—Tall spike of deep rose-coloured flowers, with a white centre, each segment striped with white.

35. Michigan.—Bright scarlet flowers, with a white throat.

36. Mr. Janson.—Handsome spike of bright rose-coloured flowers, shaded with purple towards the edges of the segments, the lower ones blotched with cream-white.

37. Pollux.—Scarlet flowers, streaked and mottled with crimson, the

inner segments carmine, with a light centre; the basal half of the lower segments cream-white.

38. Protée.—Tall spike of shapely flowers, the inner segments pale purple streaked with white, the outer ones orange-scarlet, blotched with white and faintly edged with purple.

39. Psyche.—Large pale rose-purple flowers, mottled and streaked with white.

40. Romeo.—Large spike of bold silvery rose flowers, blotched with crimson on the lower segments. Externally the colour is deep rose.

41. Soleil Couchant.—Sturdy spike of large well-formed rosy-purple flowers, with a pale throat. The upper portion of segments rosy red, with a faint suspicion of violet.

42. Splendens.—Light purple flowers, with a cream throat streaked with purple.

43. Thérèse de Vilmorin.—Lovely primrose-yellow flowers, with a purple centre, the basal portion of the lower segments stained with purple.

III.—Lemoinei Varieties.

44. Auguste Vacquerie.—A handsome spike of large cream-coloured flowers, slightly suffused with pink near the apex, deeply blotched with purplish crimson in the throat, and distinctly edged with primrose-yellow on the lower segments.

45. Rev. W. Wilks, **A.M.** September 9, 1890.—Handsome orange-scarlet flowers, stained with crimson at the base of the throat.

46. Spitzberg.—Tall spike of shapely white flowers, suffused with pink and blotched with crimson at the base of the throat.

47. Tricolore.—Small compact pale lilac flowers, the basal portion of the lower segments stained with violet and crimson, and edged with pale yellow.

IV.—Nanceianus Varieties.

48. General Duchesne, **A.M.** July 27, 1897.—Vigorous spike of unusually large crimson flowers, the basal half of the lower segments cream-white.

49. Jean Dybowski, **A.M.** August 11, 1896.—Shapely scarlet flowers, mottled with crimson and creamy-white on the lower segments.

50. Pacha.—Tall spike of large orange-scarlet flowers, the basal portion of the lower segments spotted with crimson on a yellow ground.

51. President Carnot, **A.M.** August 13, 1889.—Very large rich scarlet flowers, the lower segments stained with cream-white, spotted and stained with rosy crimson.

52. President Chandon.—Tall handsome spike of large well-expanded scarlet flowers, the lower segment blotched with crimson and edged with cream.

REPORT ON MISCELLANEOUS FLOWERING PLANTS AT CHISWICK, 1901.

A.M. = Award of Merit.
× × × = Highly Commended.

AGERATUM.

1. Mauve Beauty (Watkins & Simpson).—Plant of compact sturdy habit; moderately free flowering; flowers mauve.

ANTIRRHINUMS.

2. Veitch's Improved Tall (Veitch).—A good strain of the ordinary tall-growing varieties.

ASTERS.

3. Dwarf Comet Rose Perfection (Barr).—Height 8 inches; compact bushy habit; free-flowering; flowers rich rose, with long petals.

4. Dwarf Comet White Perfection (Barr).—Flowers pure white; height and habit of growth identical with No. 3.

5. Dwarf Perfection Rose Brilliant (Barr).—Height 1 foot; flowers large, rich rose, passing to silvery rose.

6. Gloriosa (Barr).—Height 9 inches: flowers crimson, with a blush-white centre.

7. Japanese Cardinal (Veitch).—Height 1 foot; flowers small, scarlet, exterior of petals purple.

8. Meteor (Carter).—Height 1 foot; plants of compact branching habit; flowers large and variously coloured.

9. Ostrich Feather Crimson (Barr).—Height 16 inches; plants of vigorous growth, reminding one of Giant Comet, very free-flowering; flowers large, rosy crimson.

10. Ostrich Feather pure white (Barr).—A large pure white-flowered form of No. 9.

11. Ostrich Feather pure white, changing to azure blue (Barr).—This differs from No. 10 by reason of its white flowers changing to blue.

12. Ostrich Feather Rose (Barr).—Flowers large, bright rose, passing to a paler shade.

13. Phœnix Little Maid (Barr).—Height 15 inches; plants of compact habit; flowers of various colours, but principally white, suffused with pink and rose.

14. Sinensis (Latter).—Height 16 inches; plants of branching habit, with deep green leaves; very free-flowering; flowers large, nearly 4 inches across, mauve ray florets with a prominent yellow disc. A continuous bloomer and the best of all late-flowering single Asters.

15. Triomphe des Marchés (Barr).—Height 1 foot; plants of sturdy habit; moderately free-flowering; flowers large, with broad curling rose-coloured petals, edged with white.

16. Veitch's dwarf pyramidal bouquet white (Veitch).—Height 7 inches; plants of compact habit; free-flowering; flowers pure white.

BEGONIAS.

17. Semperflorens compacta light rose (Veitch).—Plants of bushy habit; very free-flowering; flowers rather small; colour rose-pink.

18. Semperflorens compacta rose (Veitch).—Rose-coloured flowers, shaded with white.

19. Semperflorens compacta scarlet (Veitch).—Flowers bright scarlet; plants dwarf and very bushy.

20. Semperflorens white (Veitch).—Flowers pure white, borne with great freedom.

21. Frilled Beauty (Tuberous) (R. Veitch).—Large, handsome, single and semi-double variously-coloured flowers, with fringed petals.

CALANDRINIA.

22. Grandiflora (Veitch).—A distinct and pretty plant, of bushy spreading habit, with fleshy pale green leaves and numerous single flowers, 2 inches across, borne on branching stems 20 inches high; colour rose, with a prominent central cluster of yellow anthers. It grows about a foot high, and was introduced from Chili in 1826.

23. Umbellata (Veitch).—A half-hardy biennial, introduced from Peru about the same time as the last-named. It grows 4 inches high, is of bushy spreading habit, with linear green leaves covered on both sides with slender glaucous hairs; flowers small, purple, touched with crimson, borne in terminal corymbs on slender wiry stems in great profusion. A continuous bloomer, and serviceable for edgings.

The Calandrinias are splendid rock-garden plants, and succeed best in dry soils and sunny positions.

CALLIOPSIS.

24. Tom Thumb Crimson King (Veitch).—Height 9 inches; compact bushy habit; free-flowering; flowers deep crimson.

CANDYTUFT.

25. Dwarf hybrids (Watkins & Simpson).—An excellent dwarf strain, with large spikes of variously-coloured flowers.

26. Giant Hyacinth, flowered white (Watkins & Simpson).—Height 1 foot; plants of vigorous habit; free-flowering; large pure white flowers, borne on large stout spikes. It is an improvement on 'Empress.'

27. Little Prince (Barr).—Raised from 'Empress.' Height 6 inches; plants of compact habit; very free-flowering; flowers pure white, borne on sturdy stems.

28. New hybrids, dwarf mixed (Veitch).—Inferior to No. 25.

29. Rose Cardinal, **A.M.** July 16, 1901 (Watkins & Simpson).—Height 10 inches to 1 foot; plants of bushy habit; very free-flowering; flowers rose, touched with carmine. A continuous bloomer and good drought-resister.

CANNAS.

30. Duke of Marlborough (Veitch).—Dwarf habit; leaves green; flowers small, deep crimson.

31. Intensity (Godfrey).—Vigorous habit; leaves green; flowers deep maroon, with long, rather narrow petals.

32. Iona (Godfrey).—Dwarf habit; leaves green; flowers borne in large trusses, rich scarlet suffused with orange.

33. Mrs. Horn (Godfrey).—Canary-yellow flowers, spotted with brown. Similar to Frau Anna Buchner.

34. Pride of Exmouth (Godfrey).—Dwarf habit; leaves green; very large trusses of rich scarlet flowers.

35. The Sirdar (Veitch).—Dwarf habit; leaves green; free-flowering; flowers large, borne in loosely-arranged trusses, scarlet edged with golden yellow.

CARTHAMUS.

36. Tinctorius (Barr).—Height 2 feet 6 inches to 3 feet; free-flowering; rich yellow thistle-like flowers.

CELOSIA.

37. Pyramidalis dwarf coccinea (Turner).—Stock mixed.

CHRYSANTHEMUMS.

38. Carinatum Morning Star (Watkins & Simpson).—Stock not fixed.

39. Coronarium White Pearl (Watkins & Simpson).—Height 18 inches; sturdy habit; very free-flowering; flowers small, double white with a yellowish centre.

40. Princess May (Carter).—Height 2 feet; plants of branching habit; moderately free-flowering; flowers single, ray florets white, with a yellow base; disc yellow.

CLARKIAS.

41. Pulchella fl.-pl. (Watkins & Simpson).—Height 10 inches to 1 foot; bushy spreading habit; very free-flowering; flowers double, crimson, passing to carmine.

42. Pulchella double purple (Watkins & Simpson).—Height 10 inches to 1 foot; bushy habit, but not quite so floriferous as No. 41.

43. Pulchella alba fl.-pl. (Watkins & Simpson).—A double white-flowered form of No. 41.

DIANTHUS CHINENSIS.

44. Heddewegii, Barr's extra choice mixed (Barr).—A very fine strain, with large variously coloured flowers.

45. Heddewegii Crimson Belle (Barr).—Height 10 inches to 1 foot; compact habit; very free-flowering; flowers large, deep crimson, touched with maroon near the centre.

46. Heddewegii laciniata double, Aurora (Barr).—A splendid strain, with large flowers; colours various, but principally of salmon shades.

47. Heddewegii laciniatus new dwarf hybrids (Barr).—A remarkably good selection with variously-coloured fringed flowers. The plants are dwarf and very floriferous.

48. Heddewegii laciniatus Salmon Queen (Barr).—Beautifully fringed bright salmon flowers, passing to a paler shade.

49. Heddewegii Queen of Holland (Barr).—Height 9 inches; very free-flowering; flowers large, white, with a rosy crimson zone near the centre.

50. Heddewegii Stellaris (Barr).—Height 9 inches; flowers single, crimson, streaked and margined with white.

ERYSIMUM.

51. Dwarf compact (Veitch).—Height 10 inches; sturdy bushy habit; small rich yellow flowers.

ESCHSCHOLTZIA.

52. Compacta Rose Queen (Watkins & Simpson).—Height 1 foot; compact habit; leaves deeply divided and very glaucous; flowers rose, flaked with white, the exterior of petals bright rose.

53. Compacta Mandarin (Watkins & Simpson).—Flowers rich orange-red. The plants are not quite so bushy as No. 52.

54. Crispa (Barr).—Height 1 foot; free-flowering; flowers cream-white, with a faint suspicion of pink; externally the colour is lovely rose.

55. Douglasii (Barr).—Flowers small, deep buttercup-yellow, with a darker centre.

56. Golden West (Barr).—Large pale yellow flowers, blotched with deep orange. An early and continuous bloomer.

GAILLARDIA.

57. Grandiflora compacta (R. Veitch).—Height 2 feet; very free-flowering; flowers large, flat, borne on long stems, rich yellow, stained with orange on the lower portion of petals. Very showy when planted in masses.

GODETIA.

58. Sunset (Watkins & Simpson).—Height 10 inches; very bushy habit; exceptionally free-flowering; flowers large, rosy crimson, with a white centre.

GYPSOPHILA.

59. Elegans alba, × × × July 27, 1898 (Veitch). Height 14 inches; plants of graceful habit and wonderfully free-flowering; flowers small, pure white.

HELIOTROPES.

60. Dwarf Giant (Veitch).—Plants of bushy habit; free-flowering; mauve-coloured flowers with a white centre, borne in great heads.

61. Giant Blue (Veitch).—Stock mixed.

62. Giant White (Veitch).—Stock mixed.

LEPTOSYNE.

63. Stillmanni (Veitch).—An uncommon Californian annual, 18 inches or so high; compact bushy habit, with deep green deeply-divided leaves; very free-flowering; flowers small, rich yellow, borne on long stems at the apex of the shoots.

LOBELIA.

64. Newport's Model (Newport).—A dwarf bedding variety, with large deep blue flowers with a white eye.

MIGNONETTE.

65. Bismarck (Barr).—Plants of compact bushy habit; very free-flowering; flowers similar to those of Machet, borne on strong spikes well above the foliage.

66. Giant Crimson (Watkins & Simpson).—Plants of vigorous branching habit; very free-flowering; flowers brownish-red, borne on massive spikes.

67. Nineteen Hundred (Barr).—Plants of bushy habit; flowers small, borne on rather slender spikes.

68. Perfection (Carter).—Plants of good habit; very free-flowering; flowers red, borne on rather small spikes.

NASTURTIUMS.

69. Tall Terra-cotta (Veitch).—Height 18 inches; very free-flowering; flowers partly hidden by foliage; colour terra-cotta streaked with crimson.

70. Tom Thumb Ardoise (Barr).—Plants of dwarf bushy habit; flowers thrown well above the foliage; colour deep yellow spotted with chocolate-brown.

PAPAVER.

71. Miss Sherwood (Veitch, Barr).—Lovely pure white flowers, edged with rose.

PETUNIAS.

72. Yellow-throated (Line).—A fairly good strain, with large variously coloured flowers, mostly with yellow throats. Requires further selection.

73. Phlox Drummondii. See Vol. XXV. p. 387.

SALPIGLOSSIS.

74. Mammoth mixed (Carter).—An excellent strain, with large richly-coloured flowers.

SCHIZANTHUS.

75. Papilionaceous compactus (Watkins & Simpson).—Height 18 inches; plants of branching pyramidal habit; very free-flowering; flowers pale purple, spotted and flaked with white and blue; lip white, marked with dark blue, the upper portion pale purple.

76. Pinnatus roseus compactus (Watkins & Simpson).—Height 16 inches; plants of branching habit; flowers rose, passing to blush-white.

SPRAGUEA.

77. Umbellata. See Vol. XXV. p. 388.

STACHYS.

78. Coccinea (Veitch).—A tender perennial introduced from Chili upwards of a hundred years ago. It grows about 18 inches high, and is

of sturdy habit; leaves oblong cordate, rather rugose, 2 inches long; small scarlet flowers, borne in whorls.

STOCKS.

79. A collection of Stocks planted out on a south border made little growth and flowered sparingly.

SWEET PEA.

80. Lord Salisbury (Carter).—Well-formed flowers, with dark purple standards and violet blue wings.

TAGETES (MARIGOLD).

81. Silver King (Carter).—Plants of bushy compact habit; very free-flowering; flowers yellow, blotched with maroon at the base of the petals.

TULIPS.

82. Bridesmaid (Veitch).—Height 16 inches; flowers rosy scarlet, streaked and suffused with white; blue centre.

83. Greigii (Veitch).—Large handsome scarlet flowers, blotched with black. Grand for massing.

84. Van Berghem (Veitch).—Height 8 inches; bold cap-shaped flowers, with broad petals; colour deep rosy pink, with a yellow base.

85. Admiral Renier (Veitch) . . . . .
86. Billietiana Sunset (Veitch) . . .
87. Buenoventura (Veitch) . . . .
88. Couronne d'Or (Veitch) . . . .
89. Grace Darling (Veitch) . . . .
90. Hector (Veitch) . . . . See Vol. XXV.
91. La Matelas (Veitch) . . . . p. 178.
92. Parisian Yellow (Veitch) . . . .
93. Queen of the Netherlands (Veitch) . .
94. Royal White (Veitch) . . . .
95. Toreador (Veitch) . . . . .
96. Vitellina (Veitch) . . . . . .

VERBENA.

97. Erinoides (syn. V. multifida) (R. Veitch).—A rather uncommon species, introduced from Peru in 1818. Height 18 inches; plant of slender branching habit; leaves bright green, deeply cut; small purple flowers, borne on wiry stems in terminal spikes.

98. Erinoides alba (R. Veitch).—A white-flowered form of No. 97.

99. Mammoth (Carter).—Plant sof straggling habit; moderately free-flowering; flowers rich rose.

ZINNIA.

100. Mammoth mixed (Carter).—A splendid strain. Flowers large and variously coloured.

REPORT ON PLUMS AT CHISWICK, 1901.

A COLLECTION of Plum-trees was presented to the Gardens in the spring of 1894, and these were all lifted and replanted in 1897 on ground that had been formerly occupied by Apple-trees. All the varieties were planted in alphabetical order, so that any one in particular could easily be found if wanted. For a number of years 'Grand Duke' has always been the first to blossom, being generally in flower on April 9, followed by 'Bittern' on April 15. All the other varieties blossomed on April 22 or 23, there being practically no difference in that respect between the early and late ripening varieties. Until 1901 the climatic conditions were so unfavourable that it was not possible to get a complete report of the fruit of each variety, as on several occasions the spring frosts destroyed the fruit after it was set; but the spring of 1901 being favourable, all the varieties, with about two exceptions, bore crops of fruit, and afforded an excellent opportunity for comparison and observation. All the trees are grown in bush form, and planted 9 feet apart each way, the growth in every case being very satisfactory, the light soil at Chiswick suiting Plum-trees generally.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.

1. Archduke (Lane).—Fruit large, oval, deep bluish-purple, and having a rather deep suture; stalk ½ inch long and deeply inserted; freestone; very heavy crop; foliage of medium size, with large glands; habit erect and vigorous. An excellent late cooking variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 17.

2, 3. Angelina Burdett (Fraser, Rivers).—Fruit of medium size, round, dark red shaded with purple, and covered with minute brown dots; suture shallow; stalk ½ inch long, set in a shallow cavity; flesh green, tinged with red; clingstone; foliage of medium size, with very small glands; habit bushy and compact; good crop; shoots smooth. A delicious dessert variety that hangs well on the trees for some time after it is ripe. Ready August 22.

4, 5. Autumn Compote (Fraser, Lane).—Fruit large, oval, bright red, covered with minute brown dots, and with a shallow suture; stalk rather over ½ inch long and set in a deep close cavity; clingstone; light crop; foliage and glands large; habit erect, compact, and vigorous; shoots smooth. A late cooking variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 12.

6. Belgian Purple (Rivers).—Fruit of medium size, deep round, dark purple, with brown dots on most of the fruits; deep suture near the stalk, shading off to nothing near the point; stalk ¾ inch long, deeply inserted; clingstone; good crop; foliage of medium size, with small glands; habit erect, compact, and vigorous; shoots smooth. A very useful cooking variety, and in some seasons quite good enough for dessert. Ready August 19.

7. Belle de Louvain (Lane).—Fruit very large, long oval, bluish-purple, covered with a thick bloom; stalk 1 inch long and set in a deep cavity; suture shallow; heavy crop; clingstone; foliage very large, with two very large glands; habit erect, compact, and very vigorous; shoots smooth. A very fine cooking variety. Ready August 19.

8. Belle de Septembre (Lane).—Fruit over medium size, deep round inclining to oval, dark red and dotted with darker spots; shallow suture; stalk ½ inch long, inserted in a shallow cavity; clingstone; good crop; foliage large, long, and distinct; glands very variable in size and mostly on the petiole; habit erect and vigorous; shoots smooth. A good late cooking variety. Ready September 19.

9. Bittern (Fraser).—Fruit over medium size, oval, deep purple; very shallow suture; stalk 1 inch long, set in a shallow cavity; freestone; extraordinarily heavy crop; foliage large, with glands sometimes on leaves and occasionally on the petiole, and some leaves have no glands; habit bushy, compact, and vigorous; shoots smooth. An excellent early free-bearing cooking variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 2.

10, 11. Blue Impératrice (Rivers, Bunyard).—Fruit small, oval, purple, covered with a deep bloom; shallow suture; stalk 1 inch long, set in a small cavity; slightly clingstone; heavy crop; foliage small; glands variable in size and mostly on the petiole; habit bushy, compact, and vigorous; shoots smooth. A good late cooking variety. Ready September 20.

12. Blue Prolific (Rivers).—Fruit below medium size, oval, dark purple or blue; scarcely any suture; stalk 1 inch long, set in a very small cavity; clingstone; very heavy crop; foliage and glands large; habit compact, bushy, and vigorous; shoots smooth. A free-bearing cooking variety, but the fruit is too small in its season for it to become popular; raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 20.

13. Bonloff (Rivers).—Fruit over medium size, round, red, covered with a purple bloom and minute brown dots; shallow suture; stalk ¾ inch long, set in a small cavity; clingstone; light crop; foliage large; glands of medium size, usually on the petiole; habit erect, compact, and vigorous; shoots smooth. A delicious dessert variety, but the tree is a poor cropper generally. Ready August 29.

14. Bonne Bouche Gage, **F.C.C.** September 17, 1867 (Bunyard).—Fruit below medium size, round, yellowish green, covered with a white bloom; shallow suture; stalk ¾ inch long, set in a small cavity; clingstone; light crop; foliage and glands large, the glands being usually on the petiole; habit erect and vigorous; shoots slightly downy. This Plum is of exquisite flavour, but the tree is a shy bearer. Ready September 18.

15. Bradshaw (Lane).—Fruit very large, oval, reddish purple covered with darker dots; deep suture; stalk 1 inch long, deeply inserted; slightly clingstone; very heavy crop; foliage and glands large; habit erect, compact, and vigorous; shoots smooth. A cooking variety, resembling Belle de Louvain, but the fruit is thicker and more freely produced. Ready August 20.

16. Bryanston Gage (Rivers).—Fruit of medium size, round, greenish-

yellow, covered with minute red dots; shallow suture; stalk ½ inch long, set in a small cavity; slightly clingstone; moderate crop; foliage large; glands of medium size; habit bushy, compact, and moderately vigorous; shoots smooth. A very rich-flavoured dessert variety and worthy of space on a wall. Raised at Bryanston Park, Blandford. Ready September 12.

17. Bush Plum (Bunyard).—Fruit small, deep round, dark purple, covered with minute brown dots; very shallow suture; stalk ½ inch long, deeply inserted; freestone; heavy crop; foliage of medium size with large glands; habit erect, compact, and vigorous; shoots downy. A free-bearing late cooking variety of excellent flavour. It was found in a hedge at Bobbing, near Sittingbourne, in 1836, and is also known as 'Kentish Bush.' Ready September 12.

18. Cocket Père (Rivers).—Fruit large, oval, yellow, slightly flushed with red on the exposed side, and covered with minute brown dots; shallow suture; stalk ¾ inch long, deeply inserted; clingstone; light crop; foliage of medium size, with large glands, usually on the petiole; habit diffuse and vigorous; shoots downy. This is a cooking variety of no special merit. Ready August 20.

19. Coe's Late Red (Fraser).—Fruit small, round, dark red, covered with small brown dots and a purple bloom; shallow suture; stalk ¾ inch long, in a small cavity; freestone; heavy crop; foliage and glands small; habit bushy, compact, and moderately vigorous; shoots downy. A very useful late cooking Plum. Ready September 28.

20, 21. Coe's Golden Drop (Lane, Fraser).—Fruit large, oval, with a distinct neck at the stalk, pale yellow, flaked with green, and spotted with red on the exposed side; stalk 1 inch long, inserted in a projecting point or neck; clingstone; heavy crop; foliage of moderate size; glands large; habit bushy, compact, and vigorous; shoots smooth. This well-known delicious late dessert Plum is occasionally a good bearer on bush trees; on walls it is a most reliable variety. Raised by Mr. Jervaise Coe, Bury St. Edmunds, at the end of the eighteenth century. Ready September 13.

22. Cox's Emperor (Lane).—Fruit large, deep round, inclining to oval, dark red, covered with minute brown dots; shallow suture; stalk very thick and ½ inch long, deeply inserted; slightly clingstone; good crop; foliage large; glands medium to large; habit erect, compact, and vigorous; shoots downy. This variety is better known in some parts of the country as 'Denbigh Seedling,' and is a very good free-bearing Plum that always cooks well. Ready August 22.

23. Curlew (Fraser).—Fruit large, oval, deep purple; stalk ¾ inch long, rather deeply inserted, and having a deep suture; clingstone; very heavy crop; foliage and glands large; habit erect and vigorous; shoots smooth. An early free-cropping cooking variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 9.

24. D'Agen (Fraser).—A Japanese variety that is a complete failure at Chiswick. The growth is cut back annually by the frost, and the tree never bears any fruit.

25. Decaisne (Rivers).—Fruit large, oval, pale yellow, spotted with paler dots, and lightly flushed with red on the exposed side; very shallow suture; stalk ¾ inch long and deeply inserted; clingstone; light crop; foliage of medium size, with small glands; habit compact, and weak

growth ; shoots smooth. This variety is of fair flavour for dessert, but scarcely worth growing by reason of its weak, wiry growth, and shy cropping qualities. Ready September 6.

26. Denniston's Superb (Rivers).—Fruit large, roundish oval, pale green flaked with yellow, and covered with a white bloom ; wide shallow suture ; stalk ¾ inch long, inserted in a deep cavity ; clingstone ; heavy crop ; foliage large, with small glands ; habit erect, compact, vigorous ; shoots slightly downy. A first-rate dessert variety, of exquisite flavour, and cropping well as a bush tree in the open air. Raised by Mr. Isaac Denniston, Albany, New York. Ready August 26.

27, 28. Diamond (Lane, Fraser).—Fruit very large, oval, blue-black, and covered with a deep bloom ; suture wide and distinct ; stalk 1 inch long and deeply inserted ; clingstone ; extraordinarily heavy crop ; foliage large, with medium-sized glands ; habit bushy, compact, and vigorous ; shoots downy. This variety produced the heaviest crop in the collection, and is an excellent cooking Plum. Raised by Mr. Hooker, Brenchley, Kent. Ready August 23.

29. De Montford (Rivers).—Fruit of medium size, roundish oval, purple, covered with thin stripes of brown ; shallow suture ; stalk ½ inch long and deeply inserted ; clingstone ; foliage and glands of medium size ; habit bushy, compact, and vigorous ; shoots downy. A pleasant-flavoured dessert variety, but a light cropper. Ready August 23.

30. Early Favourite (Lane). Fruit a little below medium size, round, deep blue-black, covered with a thick bloom ; shallow suture ; stalk very short and set in a narrow cavity ; freestone ; very heavy crop ; foliage small, with very small glands, some leaves glandless ; habit bushy, compact, and moderately vigorous ; shoots downy. A valuable early Plum, equally good for cooking or dessert, and a most reliable cropper. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready July 20.

31, 32. Early Orleans (Lane, Fraser). Fruit of medium size, round, and rather flat at the apex, reddish purple ; shallow suture ; stalk ½ inch long and deeply inserted ; freestone ; heavy crop ; foliage and glands large, the latter usually on the petiole ; habit diffuse and moderately vigorous ; shoots downy. A good cooking variety and of fair quality for dessert. Ready August 2.

33. Early Yellow, **F.C.C.** August 13, 1901 (Fraser).—Fruit rather small, oval, and of beautiful golden yellow, covered with a white bloom, and having a faint suture ; stalk ½ inch long and set in a very shallow cavity ; freestone ; very heavy crop ; foliage and glands small ; habit bushy, slender, and compact ; shoots downy. A cooking variety valuable for its earliness. Ready July 17. This is synonymous with White Primordian.

34. Early Transparent Gage, **F.C.C.** July 26, 1898 (Lane).—Fruit over medium size, round, greenish yellow, spotted and flushed with red on the exposed side ; suture shallow ; stalk ½ inch long and deeply inserted ; freestone ; heavy crop ; foliage large, glands small ; habit bushy, compact, and vigorous ; shoots downy. This is an excellent dessert variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 20.

35, 36. Gisborne's (Bunyard, Fraser).—Fruit rather large, oval, deep yellow, covered with minute red dots ; freestone ; stalk ½ inch long and

deeply inserted; shallow suture; foliage and glands large; habit erect, compact, vigorous; shoots downy. An excellent cooking variety, producing heavy crops of fruit on bush or wall trees.

37. Goliath (Fraser).—Fruit large, deep round or oblong, reddish-purple, covered with a deep blue bloom, and having a broad suture; stalk 1 inch long and deeply inserted; clingstone; good crop; foliage of medium size; glands small; habit diffuse and vigorous; shoots downy. A very useful cooking Plum. Ready September 7.

38. Golden Esperen (Rivers).—Fruit large, oval, pale yellow, dotted with minute red spots; wide, shallow suture; stalk $\frac{3}{4}$ inch long, inserted in a small cavity; foliage and glands rather small; habit compact and vigorous; shoots smooth. A very handsome Plum of fair quality, parting freely from the stone, but the tree is an indifferent cropper. Ready August 15.

39. Golden Transparent Gage, **F.C.C.** September 12, 1893 (Rivers).—Fruit large for a Gage, round, yellow, spotted with pale and also red dots; shallow suture; stalk $\frac{1}{2}$ inch long, deeply inserted; freestone; very light crop; foliage large and distinct, with very small glands; habit bushy, compact, and vigorous; shoots smooth. This is a delicious Plum when grown against a wall, but is not a success when grown as a bush tree in the open air. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 18.

40, 41. Grand Duke, **F.C.C.** October 12, 1880 (Lane, Fraser).—Fruit large, oval, dark purple, with a wide, shallow suture; stalk $\frac{3}{4}$ inch long, inserted in a small cavity; clingstone; very heavy crop; foliage large, with small glands; habit bushy, compact, and vigorous; shoots smooth. A very fine and valuable late Plum, cropping equally well against a wall, as a bush tree, or orchard standard. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 18.

42. Greengage (Lane).—Fruit rather small, round, green, faintly marbled with red on the exposed side; shallow sature; stalk $\frac{1}{2}$ inch long, inserted in a small cavity; freestone; moderate crop; foliage of medium size, with small glands; habit bushy, compact, vigorous; shoots smooth. This is the well-known and delicious old Greengage.

43, 44. Guthrie's Late Green (Fraser, Rivers).—Fruit over medium size, round, pale green, flaked with a darker green, and covered with a light bloom; shallow suture; stalk $\frac{1}{2}$ inch long and rather deeply inserted; clingstone; very heavy crop; foliage large; glands of medium size, and usually on the petiole; habit bushy, compact, and vigorous; shoots smooth. A most delicious dessert Plum, and the tree produced the heaviest crop of all the Gages. Raised by the late Mr. Guthrie, Tay Bank, Dundee. Ready August 30.

45. Heron (Rivers).—Fruit large, deep oval, dark red shaded with purple, and covered with minute brown dots; shallow suture; stalk $\frac{1}{2}$ inch long and deeply inserted; slightly clingstone; good crop; foliage large, glands small; habit very diffuse and vigorous; shoots smooth. This is a cooking variety very similar to 'Cox's Emperor,' but somewhat earlier, and 'Cox's Emperor' has downy shoots. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 19.

46, 47. Jefferson (Lane, Fraser).—Fruit large, oval, pale yellow,

covered all over with minute red dots, and lightly flushed with red on the exposed side; very shallow suture; stalk ½ inch long and inserted in a small cavity; nearly freestone; good crop; foliage and glands large; habit erect, compact, and very vigorous; shoots smooth. A well-known and first-rate dessert Plum. Raised by Judge Buel, in America, and named in honour of President Jefferson. Ready September 6.

48. July Greengage (Lane).—Fruit rather large for a Gage, round, greenish-yellow, slightly spotted and flushed with red on the exposed side; stalk short and deeply inserted; deep suture; clingstone; good crop; foliage and glands large; habit erect, compact, and vigorous; shoots slightly downy. An excellent and fine-flavoured dessert variety, producing heavier crops than the old Greengage. Ready August 7.

49. Kelsey (Lane).—This is another Japanese variety that is of no value in the open air.

50. Kirke's (Fraser).—Fruit rather large, round, dark purple and marked with paler dots; very shallow suture; stalk ¾ inch long and inserted in a small cavity; freestone; light crop; foliage of medium size, with small glands; habit bushy, compact, and vigorous; shoots smooth. A delicious dessert Plum, better from trees against a wall than from trees in the open. Introduced by Mr. Joseph Kirke, Brompton, London, and originated in Mr. Poupart's market garden at Brompton. Ready August 21.

51. La Délicieuse (Bunyard).—Fruit of medium size, long oval, reddish-purple, covered with a purple bloom; shallow suture; stalk ¾ inch long and deeply inserted; slightly clingstone; heavy crop; foliage of medium size, glands small, on many leaves no glands at all; habit bushy, compact, and moderately vigorous; shoots smooth. A rather late cooking variety, the tree bearing freely. Ready September 7.

52. Late Transparent Gage, **F.C.C.** August 9, 1892 (Rivers).—Fruit large, round, pale yellow, deeply suffused with purplish red on the exposed side; shallow suture; stalk ½ inch long and deeply inserted; foliage large, glands small and usually on the petiole; habit bushy, compact, and vigorous; shoots downy. This variety is very good from a wall, but the bush trees at Chiswick have only produced one or two fruits in six years. Raised by the late Mr. Francis Rivers, of Sawbridgeworth.

53. Late Greengage (Bunyard).—This variety has not fruited at Chiswick since the tree was planted.

54. Late Black Orleans (Rivers).—Fruit of medium size, round, purple, covered with minute brown dots; shallow suture; stalk ¾ inch long and rather deeply inserted; clingstone; heavy crop; foliage small, glands usually small, but occasionally large; habit diffuse and vigorous; shoots smooth. A very good cooking variety and of fair quality for dessert. Ready September 13.

54*a*. Late Rivers (Rivers).—Fruit rather small, round, purplish-black; shallow suture; stalk 1 inch long and inserted in a small cavity; foliage and glands small; habit bushy, compact, and moderately vigorous; shoots smooth. This is a clingstone dessert Plum, valuable for its lateness, and for hanging well after it is ripe when against a wall, but of no value when planted in the open, the trees then being very shy bearers. It is the same as 'Rivers Late,' which received an **A.M.** October 23, 1894.

Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 29.

55. Mallard (Rivers).—Fruit of medium size, roundish oval, purplish-red, covered with minute darker spots; shallow suture, one side of the fruit being larger than the other; clingstone; good crop; foliage large, glands small; habit diffuse and vigorous; shoots smooth. A good cooking variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 10.

56. McLaughlin's Gage (Lane).—Fruit rather large, round, pale yellow, flushed and spotted with deep red on the exposed side, and covered with a light bloom; suture variable, on some fruits deep, on others shallow; stalk ¾ inch long and inserted in a small cavity; clingstone; heavy crop; foliage large, with very small glands, some leaves glandless; habit erect, compact, vigorous; shoots smooth. One of the finest dessert Plums. Raised by Mr. J. McLaughlin, Bangor, Maine, U.S.A. Ready August 17.

57. Mitchelson's (Rivers).—Fruit of medium size, oval, very deep purple, covered with minute brown dots; shallow suture; stalk ½ inch long, inserted in a small cavity; clingstone; good crop; foliage of medium size, glands small; habit diffuse and vigorous; shoots smooth. A useful cooking variety, raised by Mr. Mitchelson, Kingston-on-Thames. Ready August 19.

58, 59. Monarch, **F.C.C.** September 25, 1894 (Lane, Fraser).—Fruit large, blunt oval, deep bluish-purple, covered with a thick bloom; shallow suture; stalk ¾ inch long, set in a deep cavity; clingstone; very heavy crop; foliage large, some leaves have large glands, others small glands, and some leaves are glandless; habit rather diffuse and vigorous; shoots downy. This is a magnificent late cooking Plum, the trees cropping freely either against a wall or in the open. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready September 13.

60, 61. Grosse Surpasse (Lane, Rivers).—Two distinct varieties were received under this name, one having fruit like Early Orleans, and exactly similar in all respects, but a few days later in ripening. The other was a very pretty yellow Gage Plum, with medium-sized, round fruit, having a small suture; stalk ½ inch long, deeply inserted; slightly clingstone; heavy crop; foliage of medium size, small glands, usually on the petiole of the leaves; habit bushy and compact, moderately vigorous; shoots slightly downy. A very sugary, rich-flavoured Plum, and the tree a good bearer. Ready August 12.

62, 63. Nectarine (Lane, Fraser).—Fruit rather large, deep round, purple, covered with a bluish bloom and minute paler dots; deep suture; stalk ¾ inch long, set in a small cavity; slightly clingstone; heavy crop; foliage large, glands small; habit diffuse and vigorous. A free-bearing cooking variety. Ready August 15.

64. Orleans (Fraser).—Fruit of medium size, round, reddish-purple, covered with minute brown dots and a light bloom; shallow suture; stalk ½ inch long, deeply inserted; freestone; good crop; foliage of moderate size, glands large; habit bushy, compact, and vigorous; shoots downy. A good cooking Plum and of fair quality for dessert. A very old variety in 1717. Ready August 19.

65, 66. Oullins Golden Gage (Fraser, Lane). Fruit of medium size, round, greenish-yellow, with small crimson dots on the exposed side; stalk ½ inch long and deeply inserted; freestone; light crop; foliage very large, with large glands; habit erect, compact, and vigorous; shoots smooth. A very highly flavoured variety, first-rate against a wall, but not a success in the open. First brought into notice by M. Massot, of Oullins, near Lyons. Ready August 19.

67. Perdrigon Violet Hâtif (Rivers).—Fruit small, round, reddish-purple, covered with minute brown dots; shallow suture; stalk ½ inch long, deeply inserted; slightly clingstone; light crop; foliage of medium size, glands large; habit erect, compact, and vigorous; shoots slightly downy. A nice-flavoured dessert Plum. Ready August 26.

68, 69. Pond's Seedling (Fraser, Lane).—Fruit very large, oval, deep red, covered with minute brown dots and a thick purple bloom; wide shallow suture; stalk 1 inch long, inserted in a small cavity; clingstone; heavy crop; foliage of medium size, glands large; habit bushy, compact, and vigorous; shoots slightly downy. This is a rather late, free-bearing and excellent cooking Plum. Ready September 7.

70. Poupart's (Lane).—Fruit of medium size, round, purplish-red, and covered with minute brown dots; shallow suture; stalk ½ inch long and deeply inserted; slightly clingstone; very heavy crop; foliage of medium size, glands large; habit erect, compact, and vigorous; shoots downy. An excellent and prolific late cooking Plum, hanging well on the trees. Raised by the late Mr. Poupart, of Brompton. Ready September 9.

71, 72. Prince of Wales (Lane, Fraser).—Fruit over medium size, deep round, reddish-purple, covered with minute brown dots; deep suture; stalk ½ inch long and deeply inserted; slightly clingstone; very heavy crop; foliage and glands large; habit erect, compact, and vigorous; shoots slightly downy. A free-bearing cooking variety, and of fair quality for dessert. Raised by the late Mr. Chapman, of Brentford. Ready August 15.

73, 74. Prince Englebert (Lane, Fraser).—Fruit rather large, oval, dark purple, covered with minute brown dots; shallow suture; stalk ½ inch long, deeply inserted; clingstone; good crop; foliage and glands large; habit erect, compact, and vigorous; shoots downy. A very useful and reliable cooking Plum. Ready August 15.

75. Purple Gage (Bunyard).—Fruit rather small, round, purplish red, and covered with minute brown dots; shallow suture; stalk ½ inch long, set in a small cavity; slightly clingstone; light crop; foliage large, glands small and usually on the petioles of the leaves; habit bushy, compact, and moderately vigorous; shoots smooth. This is a delicious dessert Plum, but the tree does not crop very freely in the open. Ready September 7.

76. Red Gage (Bunyard).—Fruit of medium size, round, dark red, covered with brown dots; very shallow suture; stalk very short and deeply inserted; clingstone; good crop; foliage of medium size, also glands, many leaves glandless; habit erect, compact, and moderately vigorous; shoots smooth. This is a first-rate dessert Plum, and the tree is fairly productive. Ready August 19.

77. Red Magnum Bonum (Lane).—Fruit very large, long oval, reddish purple; wide shallow suture; stalk ½ inch long, inserted in a small cavity; freestone; good crop; foliage and glands of medium size, the glands sometimes at the base of the leaf, and sometimes on the petiole; habit erect, compact, and vigorous; shoots smooth. A good cooking variety, but the tree is not a very productive one in the open. Ready August 16.

78. Reine Claude de Bavay (Rivers).—Fruit rather large, round, green, covered with minute pale dots and a thin bloom; shallow suture; stalk] inch long and deeply inserted; freestone; light crop; foliage large; glands small; habit erect, and very vigorous; shoots smooth. A richly-flavoured dessert variety. Ready September 14.

79. Reine Claude Comte d'Althann (Lane).—Fruit medium to large, round, pale greyish green, deeply flushed and dotted with red, and covered with a beautiful white bloom; shallow suture; stalk ½ inch long and deeply inserted; freestone; very heavy crop; foliage of medium size, glands large and usually on the petiole of the leaf; habit bushy, compact, and vigorous; shoots slightly downy. This is a remarkably good dessert Plum, succeeding equally well as a wall tree, bush, or standard, and wonderfully prolific. Raised by the late Herr Prochasta, of Swoyschitz, Bohemia. Ready August 22.

80, 81. Rivers' Early Prolific, **F.C.C.** August 13, 1895 (Fraser, Lane).—Fruit rather small, deep round, dark purple, almost blue; stalk very short and inserted in a small cavity; nearly freestone; very heavy crop; foliage small, with large glands; habit bushy, compact, and moderately vigorous; shoots slightly downy. A very early and valuable cooking Plum, of fair quality for dessert, and it is a great and constant bearer. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready July 23.

82, 83. Sultan, **F.C.C.** August 20, 1878 (Lane, Fraser).—Fruit over medium size, round, reddish purple; wide shallow suture; stalk ½ inch long, inserted in a small cavity; slightly clingstone; good crop; foliage large, glands small; habit diffuse and vigorous; shoots slightly downy. This is a very free-bearing cooking variety, succeeding very well in the open. Raised by the late Mr. Francis Rivers, of Sawbridgeworth. Ready August 23.

84. Early Windsor (Thomas).—Synonymous with Golden Esperen.

85, 86. The Czar (Fraser, Lane).—Fruit of medium size, roundish oval, purple; rather deep suture; stalk ½ inch long, inserted in a small cavity; slightly clingstone; very heavy crop; foliage and glands large, some leaves glandless; habit erect, compact, and vigorous; shoots downy. An excellent and very productive cooking variety. Raised by Mr. Francis Rivers, of Sawbridgeworth. Ready August 2.

87. Transparent Gage (Lane).—Fruit rather large, round, pale yellow, deeply suffused with purplish red on the exposed side and covered with a delicate bloom; shallow suture; stalk ½ inch long and deeply inserted; slightly clingstone; only a few fruits have been produced during the past six years; foliage large, glands small, and usually on the petiole of the leaf; habit bushy, compact, and vigorous; shoots slightly downy. A rich dessert variety, but a very poor bearer in the open. Ready September 18.

88, 89. Victoria (Fraser, Lane).—Fruit large, oval, bright red, covered with minute brown dots and a thin bloom; rather deep suture; stalk ¾ inch long and deeply inserted; freestone; very heavy crop; foliage and glands large; habit rather diffuse and vigorous; shoots downy. A well-known and popular cooking and market Plum, and one of the best of its season. This variety was discovered in a garden at Alderton, Sussex, and was sent out in 1844 by Mr. Denyer, Brixton, as Denyer's Victoria. Ready August 22.

90. Washington (Lane).—Fruit rather large, deep round, greenish yellow marked with darker green, and faintly flushed with red on the exposed side; deep suture near stalk, which is ½ inch long, deeply inserted; freestone; light crop; foliage large, glands small; habit bushy, compact, and very vigorous; shoots smooth. A dessert variety of moderate quality, and the tree is not a good bearer. Introduced from New York by the late R. Barclay, Esq., in 1819. Ready August 20.

91, 92. White Magnum Bonum (Fraser, Lane).—Fruit very large, oval, yellow flaked with green, and often covered with deep green spots and a thin bloom; wide and rather deep suture; stalk ¾ inch long, deeply inserted; foliage large, glands small, many leaves glandless; habit erect, compact, and vigorous; shoots smooth. A cooking and clingstone Plum that does not crop well at Chiswick. Ready August 26.

93, 94. Winesour (Fraser, Rivers).—Fruit rather small, oval, purple, covered with minute yellow dots; shallow suture; stalk ½ inch long and deeply inserted; clingstone; good crop; foliage of medium size, glands large and usually on the petiole of the leaves; habit compact, bushy, and vigorous; shoots downy. A very old cooking variety. Ready September 7.

95. Wyedale (Lane).—Fruit of medium size, roundish oval, deep purple covered with a paler bloom; faint suture; stalk ½ inch long, deeply inserted; clingstone; heavy crop; foliage large, also glands, which are usually on the petiole of the leaf; habit diffuse and vigorous; shoots smooth. A cooking Plum valuable for its lateness, and for keeping sound on the trees after it is ripe. Ready September 23.

96. Yellow Magnum Bonum (Rivers).—Same as White Magnum Bonum.

The following are Damsons and Bullaces:—

97. Bradley's King of the Damsons (Bunyard).—See 'King of the Damsons.'

98. Cheshire Damson (Bunyard).—This never fruits on the light soil at Chiswick.

99. Farleigh Damson (Fraser).—Fruit small, roundish oval, blue-black; faint suture; stalk ½ inch long, inserted in a very shallow cavity; clingstone; very heavy crop; foliage and glands small; habit erect, compact, and moderately vigorous; shoots downy. A very good free-cropping late variety. Ready September 21.

100. Frogmore Prolific (Bunyard).—Fruit large, blunt oval, blue-black, covered with minute brown dots; shallow sature; stalk ½ inch long and rather deeply inserted; slightly clingstone; heavy crop; foliage large, glands of medium size; habit erect, compact, and vigorous; shoots smooth. This is an excellent variety. Ready September 9.

101. Herefordshire Prune (Bunyard).—Fruit small, oval, blue-black; faint suture; stalk ½ inch long and inserted in a very shallow cavity; clingstone; moderate crop; foliage and glands of medium size, the latter usually on the petiole of the leaf; habit very bushy and vigorous; shoots downy. Ready September 20.

102. King of the Damsons (Fraser).—Fruit large, oval, blue-black; scarcely any suture; stalk ½ inch long, inserted in a small cavity; clingstone; heavy crop; foliage large, glands small; habit bushy, compact, and vigorous; shoots smooth. An excellent free-cropping variety. Ready September 20.

103. Mirabelle (Rivers).—Fruit small, round, pale yellow; shallow suture; stalk ½ inch long, inserted in no cavity; foliage very small, glands also small; habit erect, compact, and vigorous; shoots downy. A very free-bearing early variety. Ready August 15.

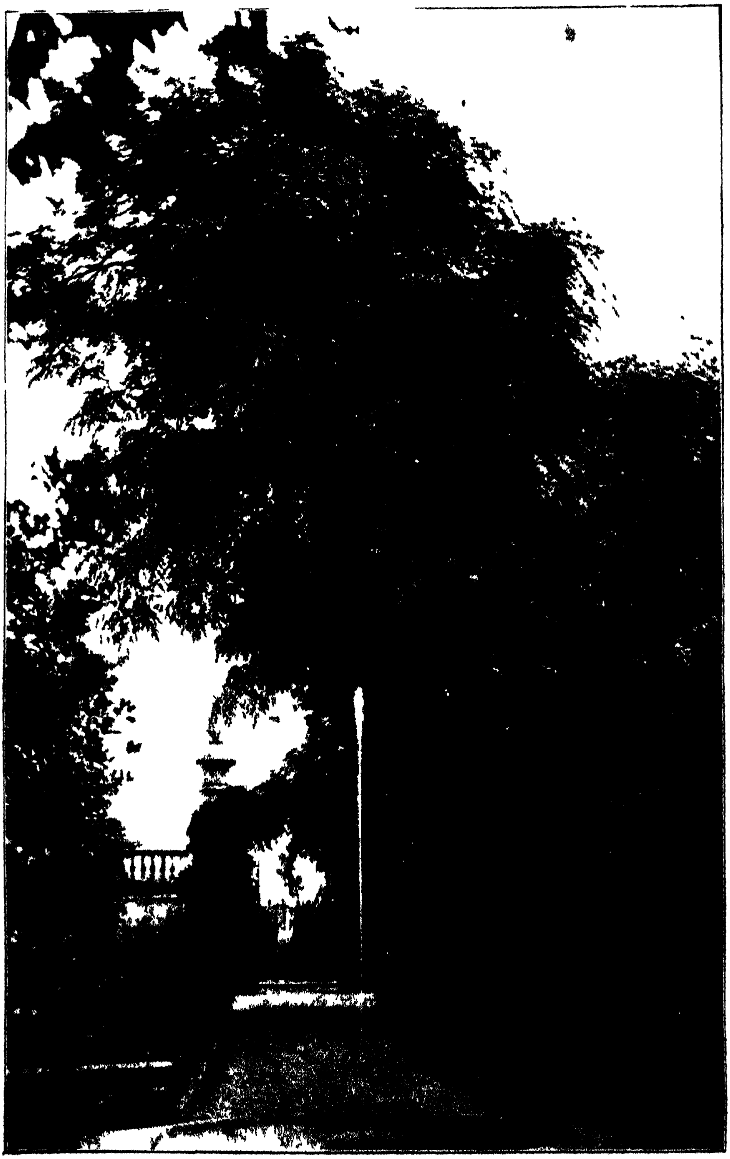
104. New Large Bullace (Rivers).—This is very similar to Shepherd's Bullace, but the foliage is larger, with small glands, and many leaves are glandless; the habit, too, is more vigorous, and the tree is a much lighter bearer. Ready September 20.

105. Rivers' Early Damson, **A.M.** August 14, 1900 (Rivers).—Fruit small, round, deep purple; very faint suture; stalk very short, not inserted in a cavity; clingstone; very heavy crop; foliage and glands small; habit bushy, compact, and moderately vigorous; shoots smooth. A most prolific early variety, raised by the late Mr. Francis Rivers, of Sawbridgeworth.

106. Shepherd's Bullace (Bunyard).—Fruit small, round, greenish yellow, covered with minute red spots on the exposed side; very shallow suture; stalk ½ inch long and deeply inserted; clingstone; very heavy crop; foliage and glands small; habit erect, compact, and moderately vigorous; shoots downy. A very useful fruit for late cooking purposes, and hangs well on the trees for some weeks after it is ripe. Ready September 20.

107. Shropshire Damson (Fraser).—Fruit small, oval, blue-black; no suture; stalk ½ inch long and inserted in no cavity; slightly clingstone; light crop; foliage and glands small, some leaves glandless; habit bushy, compact, and moderately vigorous; shoots downy. Ready September 20.

108. White Damson (Bunyard).—Fruit small, oval, yellow, faintly spotted with red on the exposed side; shallow suture; stalk ½ inch long, not inserted in a cavity; clingstone; light crop; foliage and glands small, majority of leaves glandless; habit diffuse and vigorous; shoots downy. Ready September 9.



JOURNAL

OF THE

ROYAL HORTICULTURAL SOCIETY.

VOL. XXVI. 1901-2.

PART IV.

EIGHTH ANNUAL EXHIBITION OF BRITISH-GROWN FRUIT.

HELD AT THE CRYSTAL PALACE, OCTOBER 10, 11, 12, 1901.

BY the holding of the Society's eighth Exhibition of British-grown Fruit at so late a date as the second week in October it was hoped that the late varieties of Apples and Pears would be shown in better condition than is possible three weeks or a month earlier, and that growers from the Midlands and the North would appear in greater force than they had hitherto done. That it had a little effect in these directions was evident, but not nearly to such an extent as had been hoped, and influential exhibitors were not backward in urging that the earlier dates of former years should be returned to. It is difficult to say whether the season of 1901 should be considered a good all-round season or not, as opinions from different parts of the country indicated that the weather must have been unusually local and variable. It may, however, be roughly assumed that the Apple crop was below the average, and the Pear and Plum crops distinctly above. Nor had the quantity of fruit exhibited fallen off to any extent, as had been freely prophesied by opponents of the later date of the meeting; in fact, except in 1900, the year of the wonderful crop of all fruits, there have never been so many dishes shown as in 1901, which was only some 150 dishes less than in 1900. The correctness of the naming of the varieties was considered remarkable when contrasted with the state of things that existed when the Society first established this Show.

We regret very much that the Crystal Palace Company are again obliged to reduce down to £50 their contribution to the expenses of the Show. This will make it all the more necessary for those who desire the Society to continue to hold it to do their utmost to promote the special fund for the prizes. For it should be borne in mind that as one of the oldest of the scientific societies of this country it has always been an

unwritten rule that, save in exceptional cases, the Society's funds should not be spent in offering money prizes but in promoting and diffusing the knowledge of the application of scientific methods and laws to the promotion of horticulture.

In their annual report the Council remark :—As an object-lesson in British fruit cultivation this Annual Show stands unrivalled, and it is of national importance. Those who have visited it from year to year cannot fail to have been impressed by the wonderful advance which has been made in the quality of the hardy fruits exhibited. And as the importance of fruit-growing in this country cannot well be over-estimated, the Council invite Fellows and their friends to support them in their efforts to maintain and improve this exhibition by visiting it, and subscribing to its funds. For it cannot be too widely known that the continuance of the Show is absolutely dependent on at least £100 being raised by subscription each year towards the Prize Fund. The Show involves the Society in a very large expenditure without the possibility of any financial return. The Council cannot therefore continue it unless sufficient interest in it is taken by Fellows and their friends to provide £100 towards the Prize Fund. And this has now become even more important than heretofore, as the Directors of the Palace have signified to the Council that they feel compelled to still further decrease their contribution for 1902 by yet another £50. A glance at the list of subscribers will show how small has been the interest taken by the bulk of the Fellows. The Council would point out that this is not a local Show with a few large prizes, but that a large number of small prizes have been provided in order to secure the best fruits in each section; special prizes have been allotted to Market Growers; and Counties have been grouped in such a way that growers should not have to compete with exhibitors from localities more favoured by climatic conditions. These points will be still further extended should sufficient financial support be forthcoming. Subscriptions should be sent at once to the Secretary, 117 Victoria Street, Westminster, and if the list prove satisfactory the Schedule will be issued in April, and the Show held on September 18, 19, and 20, 1902.

LIST OF SUBSCRIBERS TO THE PRIZE FUND, 1901.

Further donations to this Fund are earnestly requested, and will be acknowledged in the Society's *Journal*.

	£	s.	d.
Balderson, H., Hemel Hempstead	1	1	0
Basham, John, Bassaleg, Newport, Mon.	0	10	6
Beebe, Alfred, Palace Road, Streatham Hill	0	10	6
Blaker, Dr. Shaw, East Grinstead	0	10	6
Blenkinsop, B., J.P., Kenley, Surrey	0	10	0
Boyd, Mrs., Woodvale Lodge, South Norwood Hill	0	5	0
Brocklehurst, Geo., Rock House, Sydenham Hill	1	1	0
Bunyard, Geo., & Co., Royal Nurseries, Maidstone	10	10	0
Bythway, W., Llanelly, South Wales	1	1	0
Challis, Thos., Wilton House Gardens, Salisbury	0	5	0
Cheal, J., & Sons, Crawley, Sussex	2	2	0
Clinch, T., Denaway, Key Street, Kent	0	2	6

		£	s.	d.
Clout, Richard, West Malling, Kent		2	2	0
Colman, Jeremiah, Gatton, Surrey		2	2	0
Coode, R. C., Polapit Tamar, Launceston		1	1	0
Cundey, Mrs., 2 Hyde Park Square, W.		2	2	0
Day, James, Galloway House Gardens, Garliestown		0	7	6
Edwards, R., Beechy Lees, Sevenoaks		0	5	0
Fennell, Geo., Fairlawn Gardens, Tonbridge		0	5	0
Fletcher, Charles E., Yalding, Kent		0	5	0
Fowke, Miss, Wellington, Shropshire		0	10	6
Fowler, J. Gurney, Glebe Land, S. Woodford		2	2	0
Gabriel, J. T., Palace Road, Streatham Hill		1	1	0
Gardiner, John, Rudgeway, R.S.O., Glos.		1	1	0
Greaves, Ben, Broome Hall Gardens, Dorking		0	5	0
Harrowby, Countess of, Grosvenor Gardens, S.W.		0	10	0
Hebeler, H. A., 94 Victoria Street, S.W.		1	0	0
Hill, Daniel, Herga, Watford		0	10	0
Horne, W., & Sons, Cliffe, Rochester		4	4	0
Hulse, Miss A., Boxgrove, Guildford		1	0	0
Hurnard, H. H., Hingham, near Attleboro'		1	1	0
Ince, Surgeon-Major, Swanley		0	5	0
Kay, P. E., Church End, Finchley, N.		1	1	0
Kemp, A., Coolhurst Gardens, Horsham		0	5	0
King, E. Powell, Lymington		0	10	0
Lawrence, Sir Trevor, Bart., 57 Princes Gate, S.W.		1	1	0
Lee, John, Bebington, Cheshire		0	10	6
Leycester, E. G., Mobberley Old Hall, Knutsford		1	1	0
Lloyd, F. G., J.P., Langley House, Bucks		3	3	0
Markendale, R. S., Bradford, Yorks		0	5	0
McIndoe, Jas., Hutton Hall Gardens, Guisboro'		1	0	0
McKenzie, J., Linton Park Gardens, Maidstone		0	10	0
McLachlan, R., F.R.S., Clarendon Road, Lewisham, S.E.		2	2	0
McLaren, Mrs. E., 56 Ashley Gardens, S.W.		1	1	0
Merryweather, H., Southwell	Prizes and	1	0	0
Mouro, Geo., Covent Garden, W.C.		2	2	0
Paulin, W. T., Winchmore Hill		2	2	0
Pearson, J. R., & Sons, Chilwell, Notts	Prizes and	1	10	0
Peed, John, & Son, Norwood Road, West Norwood		2	2	0
Potter, R., Kemsing, Sevenoaks		0	7	0
Poupart, W., & Sons, Twickenham		1	1	0
Pye-Smith, A., 32 Queen Victoria Street		1	1	0
Reid, J. W., Holly Walk, Leamington Spa		0	10	6
Richards, A., 26 Duke's Avenue, Chiswick		0	10	6
Rivers, T., & Son, Sawbridgeworth		5	5	0
Robotham, E., Stoughton Manor, St. Neots		2	2	0
Ross, Chas., Welford Park, Newbury		0	10	6
Rothschild, Leopold de, St. Swithin's Lane, E.C.		3	3	0
Rotton, Sir John, Frith Hill, Godalming		1	1	0
Savory, Rev. E., Binfield, Bracknell		1	0	0
Schröder, Baron, Staines		5	0	0
Sharpe, F., Sileby, Loughborough		0	3	0
Sherwood, N. N., Streatham Hill		1	1	0
Smith, Edwin, Ingleside, Chatham		1	0	0
Smith, James, Mentmore, Leighton Buzzard		1	0	0
Somes, Mrs., Annery House, Bideford		1	1	0
Southby, P., Bampton, Faringdon		0	5	0
Spooner, S., & Sons, Hounslow		1	1	0
Sutton & Sons, Reading		5	0	0

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	£	s.	d.
Sydenham, Robert, Tenby Street, Birmingham	1	1	0
Thomas, W. F., Hillingdon, Uxbridge	3	0	0
Turton, T., Sherborne, Dorset	0	10	6
Veitch, Jas., & Sons, Royal Exotic Nurseries, Chelsea	5	0	0
Wallace, L. A., 6 Hyde Park Gardens, W.	5	0	0
White, Mrs., Walton Hall, Kelso, N.B.	1	0	0
Whiting, R. M., Credenhill, Hereford	0	10	0
Wigan, James, Cromwell House, Mortlake	0	10	0
Willard, J., Holly Lodge Gardens, Highgate	0	10	6
Williams, H. H., Truro	1	0	0
Williamson, Miss, St. John's Wood, N.W.	1	1	0
Willmott, Miss, Warley Place, Essex	5	0	0
Woodward, G., Barham Court, Teston, Kent	1	0	0
Wyatt, A., Hatton, Middlesex	1	0	0

The following table may be interesting as comparing the number of dishes of each fruit exhibited in each of the eight years during which the Show has been held. Only exhibits under the Schedule have been included, it having been found impossible to enumerate everything shown not for competition.

Dishes of	1894	1895	1896	1897	1898	1899	1900	1901
Apples	1,027	1,938	1,083	1,485	1,494	2,203	2,069	2,217
Apricots	2	1	1	1	1	—	—	—
Bananas	—	1	—	—	—	—	—	—
Blackberries	—	—	—	—	1	—	—	—
Bullaces	5	3	1	3	1	—	—	2
Cherries	7	12	6	1	1	2	5	2
Crab Apples	—	—	—	—	—	6	27	12
Currants	—	—	—	—	2	1	—	2
Damsons	6	18	4	5	15	13	10	5
Figs	4	9	7	26	10	9	9	6
Gooseberries	1	—	—	—	2	—	—	1
Grapes	105	97	135	120	115	83	113	68
Medlars	—	2	3	5	4	5	2	9
Melons	—	10	7	8	5	4	12	6
Mulberries	—	—	—	—	—	2	—	—
Nectarines	15	18	4	11	29	19	52	2
Nuts	—	26	19	10	14	10	14	7
Passiflora	—	—	1	1	—	—	—	—
Peaches	51	80	24	77	96	67	128	29
Pears	829	779	795	677	694	842	1,099	1,230
Pines	—	—	5	3	1	2	2	3
Plums	90	101	38	115	214	79	284	50
Quinces	6	14	17	1	2	5	3	10
Raspberries	—	—	—	—	2	1	2	4
Strawberries	—	—	—	—	2	—	4	3
Tomatos	—	67	2	3	6	5	6	9
Total	2,148	3,176	2,152	2,552	2,711	3,358	3,841	3,677
Entries for competition	1,301	1,783	1,234	1,329	1,832	1,297	1,505	1,306
Visitors	23,680	36,293	26,499	27,242	29,281	30,150	40,787	26,927

THE JUDGES.

The following gentlemen kindly acted as judges, and deserve the best thanks of the Society for their oftentimes very difficult work, viz.:—

Assbee, J., Covent Garden, W.C.
Basham, J., Bassaleg, Newport, Mon.
Bates, W., Poulett Lodge Gardens, Twickenham.
Beckett, E., Aldenham House Gardens, Elstree.
Bunyard, G., V.M.H., Royal Nurseries, Maidstone.
Challis, T., Wilton House Gardens, near Salisbury.
Cheal, Jos., Crawley, Sussex.
Coomber, T., The Hendre Gardens, Monmouth.
Crump, W., V.M.H., Madresfield Court Gardens, Malvern.
Dawes, H., Ledbury Park Gardens, Ledbury.
Dean, A., 62 Richmond Road, Kingston.
Divers, W. H., Belvoir Castle Gardens, Grantham.
Douglas, J., V.M.H., Great Bookham, Surrey.
Earp, Wm., Shirley House Gardens, Croydon.
Farr, Wm., Spring Grove Gardens, Isleworth.
Fielder, C. R., North Mymms.
Fyfe, W., Lockynge Park, Wantage.
Gleeson, M., Warren House Gardens, Stanmore.
Hudson, J., V.M.H., Gunnersbury House Gardens, Acton, W.
Kay, Peter, V.M.H., Church Road, Finchley, N.
Markham, H., Northdown House Gardens, Margate.
Mortimer, S., Farnham, Surrey.
Norman, G., Hatfield House Gardens, Hatfield.
Parker, R., Goodwood, Chichester.
Pearson, A. H., The Gables, Hucknall Road, Nottingham.
Pope, W., Highclere Gardens, Newbury.
Poupart, W., Marsh Farm, Twickenham.
Reynolds, G., The Gardens, Gunnersbury Park, Acton, W.
Rivers, H., Somers, Sawbridgeworth.
Salter, C. J., Woodhatch Gardens, Reigate.
Smith, J., V.M.H., Mentmore Gardens, Leighton Buzzard.
Ward, A., Stoke Edith Park, Hereford.
Willard J., Holly Lodge Gardens, Highgate.
Woolward, G., Barham Court, Teston, Maidstone.

THE REFEREES.

The following gentlemen very kindly held themselves at the disposal of the Society to act as referees if required, viz.:—

McIndoe, J., V.M.H., Hutton Hall Gardens, Guisboro'.
Monro, G., V.M.H., Covent Garden, W.C.
Thomas, Owen, V.M.H., 25 Waldeck Road, West Ealing.
Tillman, H. E., Covent Garden, W.C.
Walker, J., Ham Common, Surrey.
Wright, J., V.M.H., Rose Hill Road, Wandsworth.
Wythes, G., V.M.H., Syon House Gardens, Brentford.

OFFICIAL PRIZE LIST.

(The address and the Gardener's name are entered on the first occurrence, but afterwards only the Owner's name is recorded.)

Division I.

Fruits, grown under Glass or otherwise.

Open to Gardeners and Amateurs only.

Note.—Exhibitors can compete in one Class only of Classes 1, 2; and of Classes 3, 4.

Class 1.—Collection of 9 dishes of Ripe Dessert Fruit:—6 kinds at least; only 1 Pine, 1 Melon, 1 Black and 1 White Grape allowed; not more than 2 varieties of any other kind, and no two dishes of the same variety.

First Prize, Silver-gilt Knightian Medal and £4; Second, £4; Third, £2.

1. Earl of Harrington, Derby (gr. J. H. Goodacre). (Fig. 270.)
2. Lady Henry Somerset, Ledbury (gr. G. Mullins).
3. C. Swinfen Eady, Esq., Weybridge (gr. J. Lock).

Class 2. Collection of 6 dishes of Ripe Dessert Fruit:—4 kinds at least; only 1 Melon, 1 Black and 1 White Grape allowed; not more than 2 varieties of any other kind, and no two dishes of the same variety. Pines excluded.

First Prize, Silver Knightian Medal and £3; Second, £2. 10*s.*; Third, £1. 5*s.*

1. Sir Charles Russell, Bart., Reading (gr. F. Cole).
2. Lady Tate, Streatham Common (gr. W. Howe).
3. R. Bedingfield, Esq., Roehampton (gr. J. Sparks).

Class 3.—Grapes, 6 distinct varieties, 3 bunches of each, both Black and White must be represented.

First Prize, Silver Challenge Cup, value Fifty Guineas, and £3; Second, £3.

The Challenge Cup was presented to the Society by Messrs. Wm. Wood & Son, of Wood Green, in celebration of the Jubilee Year of their Firm. The Winner will hold the Cup for 12 months only, when it will be again offered for competition, until it eventually becomes the property of the Exhibitor who shall have won it three years in succession.

1. Earl of Harrington (third year of winning the Cup).
2. No award.

Class 4.—Grapes, 3 distinct varieties, 3 bunches of each.

First Prize, £2. 10*s.*; Second, £1. 10*s.*; Third, £1.

1. Lord Hastings, Melton Constable (gr. W. Shingler).
2. Capt. Forester, Battle (gr. W. Camm).
3. Sir Charles Russell, Bart.

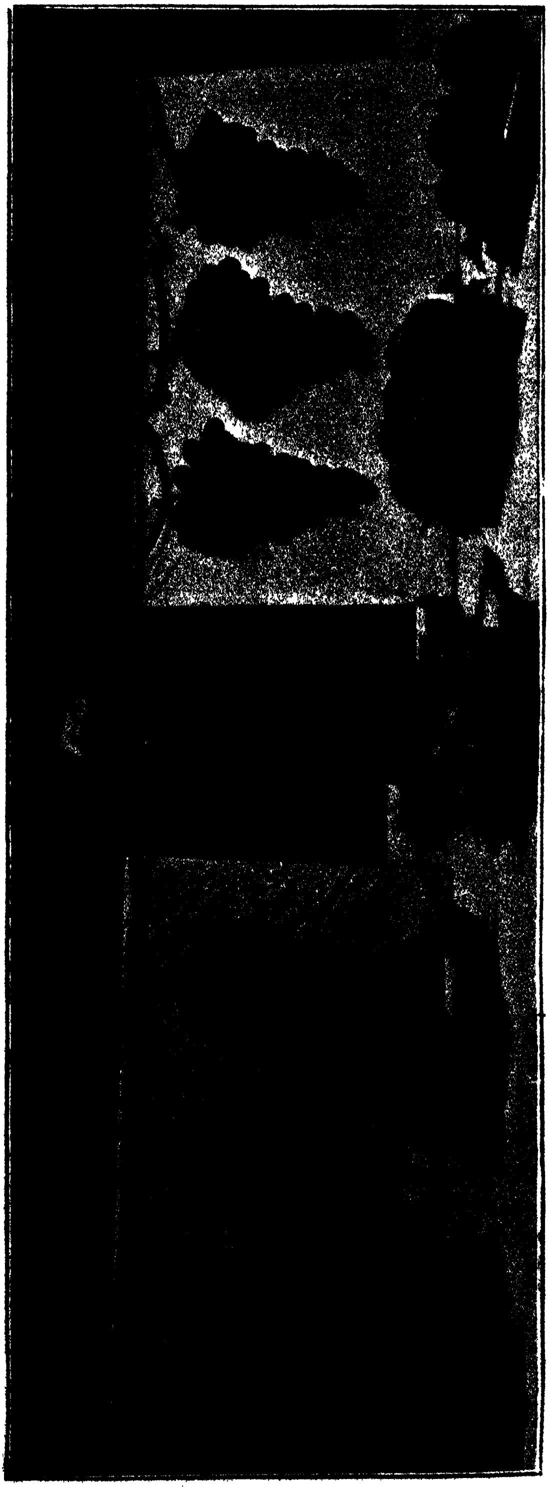

Fig. 270.—The Earl of Harrington's Prize Fruit. (*Gardeners' Magazine.*)

Class **5.**—Grapes, Black Hamburgh, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. C. Bayer, Esq., Forest Hill (gr. W. Taylor).
2. J. W. Fleming, Esq., Romsey (gr. W. Mitchell).
3. Earl of Harrington.

Class **6.**—Grapes, Mrs. Pince, 3 bunches.
First Prize, £1. 10*s.*; Second, £1.
1. J. W. Fleming, Esq.
2. Capt. Forester.

Class **7.**—Grapes, Alicante, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. Lord Hastings. (Fig. 271.)
2. J. W. Fleming, Esq.
3. Sir Charles Russell, Bart.

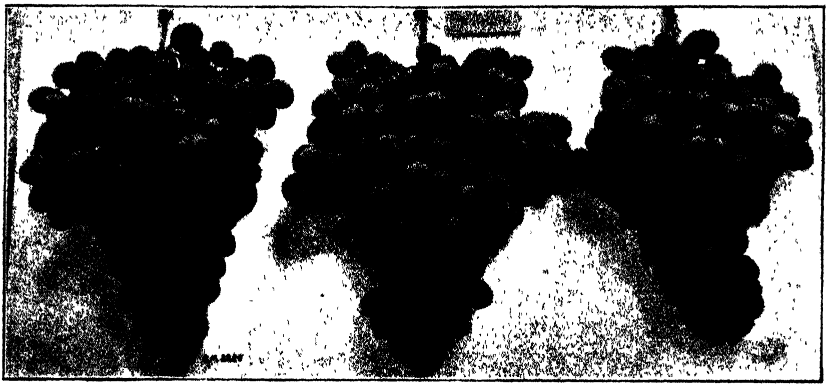

FIG. 271.—LORD HASTINGS' ALICANTE GRAPES. (*Gardeners' Magazine.*)

Class **8.**—Grapes, Lady Downes (Black), 3 bunches.
First Prize, £1. 10*s.*; Second, £1.
1. G. C. Raphael, Esq., Englefield Green (gr. H. H. Brown).
2. J. W. Fleming, Esq.

Class **9.**—Grapes, any other Black Grape, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. Lord Hastings. (Fig. 272.)
2. C. Bayer, Esq.
3. Earl of Harrington.

Class **10.**—Grapes, Muscat of Alexandria, 3 bunches.
First Prize, £2. 10*s.*; Second, £1. 10*s.*; Third, £1.
1. Sir Charles Russell, Bart.
2. Earl of Harrington.
3. Lord Hastings.

Class 11.—Grapes, any other White Grape, 3 bunches.

First Prize, £1. 10s.: Second, £1; Third, 10s.

1. Earl of Harrington.
2. Sir Charles Russell, Bart.
3. C. Bayer, Esq.

Class 12.—Collection of Hardy Fruit, 40 dishes distinct, grown entirely in the open; not to include more than 18 varieties of Apples or 12 of Pears.

First Prize, The Hogg Medal and £3; Second, £2; Third, £1.

1. Sir Mark W. Collet, Bart., Sevenoaks (gr. R. Potter).
2. Duke of Rutland, Grantham (gr. W. H. Divers).
3. T. L. Boyd, Esq., Tonbridge (gr. E. Coleman).

Class 13.—Collection of Hardy Fruit, 12 dishes distinct, grown

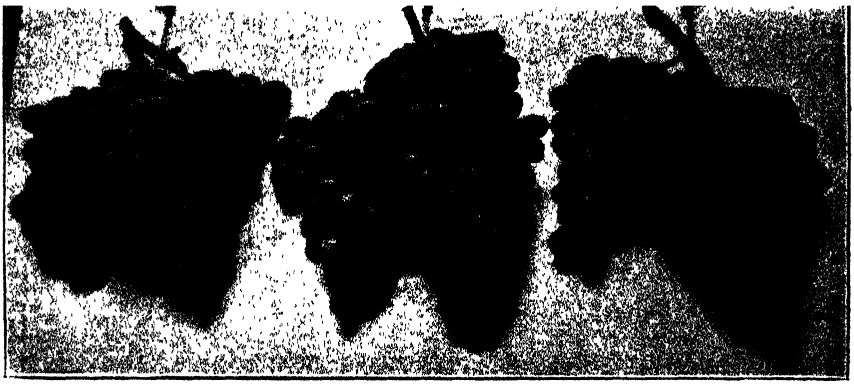

Fig. 272.—Lord Hastings' Alnwick Seedling Grapes. (*Gardeners' Magazine.*)

partly or entirely under glass to illustrate Orchard-house Culture; grapes excluded.

First Prize, £1. 10s.; Second, £1.

1. Sir Mark W. Collet, Bart.
2. No award.

Division II.

Open to Nurserymen only.

Nurserymen must exhibit as individuals or as firms, and must have actually grown all they exhibit. Combinations of individuals or firms are not allowed, nor collections of produce from districts.

Nurserymen desiring to exhibit at this Show must make application for either Class 14, 15, or 16; and also for 17 if they wish to show fruit grown under glass. No other spaces but the above can be allotted to Nurserymen wishing to show Fruit. Exhibitors can only enter in one of Classes 14, 15, and 16.

Nurserymen may adopt any method of staging they desire subject to the following reservations: (*a*) The number of Fruits is not limited, but the Baskets or Dishes must not exceed 15 inches in diameter if circular, or 19 × 15 if

rectangular; (*b*) Duplicate Trees are permitted, but not duplicate Baskets or Dishes of Fruit; (*c*) Trees are not admissible in 14, 15, 16; (*d*) A decorative central trophy not exceeding 4 feet square at the base is allowed as an extra, and the fruit thereon will not be subject to the rule (*b*) as to duplicates.

No Awards of any sort will be made to Nurserymen who do not conform to the above regulations.

IMPORTANT.—Nurserymen having entered and finding themselves unable to exhibit are *particularly* requested to give three days' notice to the Superintendent, R.H.S. Gardens, Chiswick, London, W.

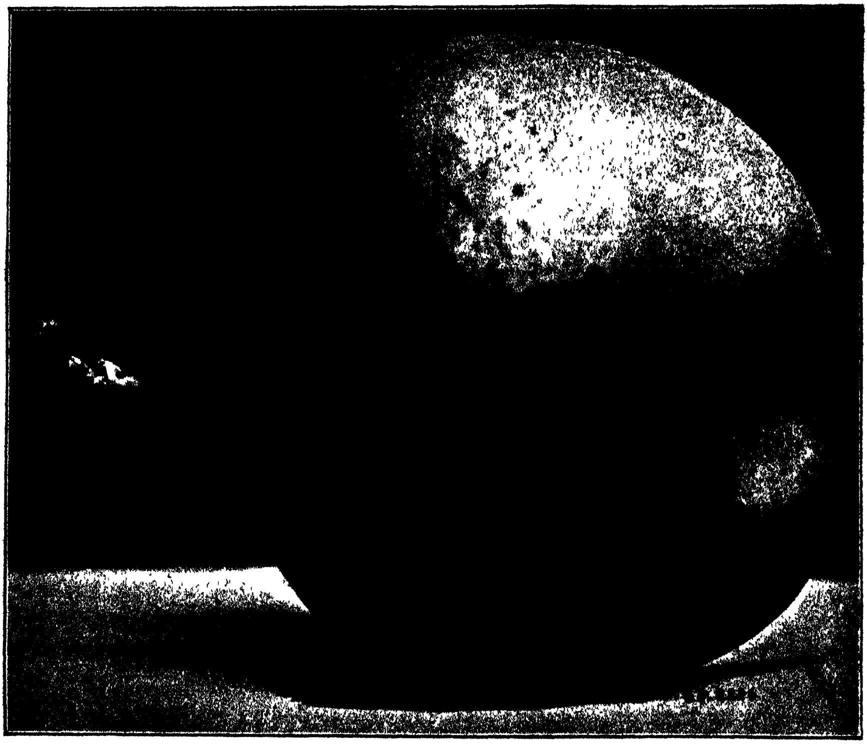

FIG. 273.—NEW PEAR, 'ST. LUKE'S.' (*Gardeners' Magazine.*)

Allotment of table-space will be made to Nurserymen on the three following scales:—

For Fruit grown entirely out of doors.

Class **14.**—48-feet run of 6-feet tabling.

First Prize, Gold Medal; Second, Hogg Medal; Third, Silver-gilt Knightian Medal.

1. Messrs. G. Bunyard & Co., Maidstone.
2. No award.
3. Messrs. H. Cannell & Son, Swanley.

Class **15.**—32-feet run of 6-feet tabling.

First Prize, Hogg Medal; Second, Silver-gilt Knightian; Third, Silver-gilt Banksian.

1. Mr. J. Basham, Bassaleg.

2. Messrs. J. Cheal & Sons, Crawley.
3. Messrs. J. Peed & Son, West Norwood. / Messrs. J. Laing & Sons, Forest Hill. } Equal.

Class 16.—16-feet run of 6-feet tabling.

First Prize, Silver-gilt Knightian; Second, Silver-gilt Banksian; Third, Silver Knightian.

1. Messrs. G. Cooling & Sons, Bath.
2. Messrs. E. Hillier & Sons, Winchester.
3. Mr. W. Tayler, Hampton.

For Orchard-house Fruit and Trees.

Class 17.—32-feet run of 6-feet tabling.

First Prize, Gold Medal; Second, Hogg Medal; Third, Silver-gilt Knightian Medal.

1. Messrs. G. Bunyard & Co.
2. Messrs. T. Rivers & Sons, Sawbridgeworth.

Messrs. Rivers' collection included magnificent examples of their new Pear, 'St. Luke's.' (Fig. 273.)

Division III.

Open to Market Growers only.

Gentlemen's Gardeners or Amateurs who sell surplus fruit, and Nurserymen, are excluded from this Division.

Market Growers must exhibit as individuals or as firms, and must have actually grown all they exhibit. Combinations of individuals or firms are not allowed, nor collections of produce from districts.

With the exception of Class 29, all fruits must be shown "as packed for travelling to Market," except that all lids, covering paper, and other surface packings are to be turned back (not removed), so as to display contents. *Boxes or Baskets piled up above the edge or rim will be considered "unsuitable for travelling," and will be disqualified.*

Other things being equal, a sieve or bushel of Apples or Pears will be considered to weigh *about* 42 lb., and a half-sieve or half-bushel 20 lb., or of Plums 28 lb., more or less.

The Judges will be men thoroughly conversant with the market, and in awarding the prizes they will be instructed to consider not only the quality of the fruit, but also the packing, the grading, and the suitability for travelling and for market purposes of the box, basket, or other receptacle in which the fruit is shown.

Class 18.—Grapes, Hamburgh, a single layer, weighing not less than 12 lb., in a baby basket.

First Prize, £2; Second, £1. 10*s*.

1. Messrs. W. & E. Wells, Hounslow.
2. Messrs. W. Poupart & Sons, Twickenham.

Class 19. Grapes, White, any variety, a single layer, weighing not less than 12 lb., in a baby basket.

First Prize, £2; Second, £1. 10*s*.

1. Mr. W. J. Batho, Finchley.
2. No award.

Class 20.—Grapes, any variety, in any other package than a baby basket, for market.

No Prize to be awarded unless the Judges consider the box, basket, or other receptacle *superior* for transit by rail to baby baskets in flats.

First Prize, £2; Second, £1. 10*s.*

1. Mr. W. J. Batho.
2. Mr. J. J. Bisson, Guernsey.

Class 21.—Apples, Cooking, 4 varieties, about 42 lb. net of each, in baskets or boxes.

First Prize, £1. 10*s.*; Second, £1.

1. Messrs. W. Poupart & Sons.
2. Mr. E. Basham, Bassaleg.

Class 22.—Apples, Dessert, 4 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1. 10*s.*; Second, £1.

1. Mr. G. Chambers, Mereworth.
2. Messrs. W. Poupart & Sons.

Class 23.—Apples, Cooking, 2 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1; Second, 15*s.*

1. Mr. G. Chambers..
2. Mr. E. Basham.

Class 24.—Apples, Dessert, 2 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1; Second, 15*s.*

1. Mr. H. T. Mason, Hampton Hill.
2. Mr. E. Basham.

Class 25.—Apples, about 42 lb. net of any one variety, in any improved form of package for market.

No prize will be awarded unless the Judges consider the box, basket, or other receptacle *superior* to those in ordinary use.

First Prize, £1; Second, 15*s.*

1. Mr. E. Basham.
2. Mr. A. J. Adcock, Ipswich.

Class 26.—Apples, about 42 lb. net of any one variety, showing any improved system of packing.

First Prize, £1; Second, 15*s.*

1. Messrs. W. Poupart & Sons.
2. Mr. E. Basham.

Class 27.—Pears, 2 varieties in 2 packages of about 20 lb. capacity each.

First Prize, £1; Second, 15*s.*

1. Mr. G. Chambers.
2. Mr. A. Wyatt, Hatton.

Class **28.**—Pears, from 24 to 48 fruits, according to size, of any one choice dessert variety, suitably packed in one package for market.

First Prize, 15*s.*; Second, 10*s.*

1. Messrs. W. Poupart & Sons.
2. Mr. A. Wyatt.

Class **29.**—Collection of 12 varieties of Apples and 6 of Pears, distinct, 18 fruits of each, to be laid flat on the table without dishes or baskets. Only vine or similar leaves allowed for decoration, and the space occupied must not exceed 16 feet × 8 feet.

First Prize, £4. 10*s.*; Second, £3.

1. Messrs. W. Poupart & Sons.
2. Messrs. W. J. Lobjoit & Son, Hounslow.

Class **30.**—Plums, a basket or box of about 28 lb. capacity, of any one variety.

First Prize, 15*s.*; Second, 10*s.*

No entry.

Class **31.**—Tomatos, a basket or box of about 12 lb. capacity, suitably packed.

First Prize, 15*s.*; Second, 10*s.*

1. Mr. C. Moon, Surbiton.
2. Mr. W. H. Dyer, Frimley.

Division IV.

Fruits Grown in the Open Air.

Open to Gardeners and Amateurs only. Nurserymen and Market Growers excluded.

Note.—Exhibitors can compete in one Class only of the Classes 32, 33, 34; of 35, 36; of 37, 38; of 39, 40, 41, 42. In distinguishing Dessert and Cooking Varieties, see Official List printed in the Schedule.

Class **32.**—Apples, 24 dishes distinct, 16 Cooking, 8 Dessert. The latter to be placed in the front row.

First Prize, £3. 10*s.*; Second, £2; Third, £1. 10*s.*

1. Roger Leigh, Esq., Maidstone (gr. G. Woodward).
2. Sir Marcus Samuel, Maidstone (gr. W. H. Bacon).
3. A. H. Smee, Esq., Hackbridge (gr. W. E. Humphreys).

Class **33.**—Apples, 12 dishes distinct, 8 Cooking, 4 Dessert. The latter to be placed in the front row.

First Prize, £2; Second, £1; Third, 15*s.*

1. Sir Mark W. Collet, Bart.
2. Duke of Richmond and Gordon, Chichester (gr. R. Parker).
3. C. J. Startup, Esq., West Farleigh (gr. T. Neale).

Class **34.**—Apples, 9 dishes distinct, 6 Cooking, 3 Dessert. The latter to be placed in the front row.

First Prize, £1. 10*s.*; Second, 15*s.*; Third, 10*s.*

1. No award.
2. Madame Stuart, Roehampton (gr. A. Smith).
3. H. C. Smith, Esq., Roehampton (gr. W. Wallace).

Class **35.**—Cooking Apples, 6 dishes, distinct.
First Prize, £1; Second, 15*s.*
1. Roger Leigh, Esq.
2. R. M. Whiting, Esq., Hereford.

Class **36.**—Cooking Apples, 3 dishes, distinct.
First Prize, 10*s.*; Second, 7*s.*
1. B. H. Hill, Esq., J.P., Crediton (gr. G. Lock).
2. C. J. Startup, Esq.

Class **37.**—Dessert Apples, 6 dishes, distinct.
First Prize, £1; Second, 15*s.*
1. Roger Leigh, Esq.
2. C. J. Startup, Esq.

Class **38.**—Dessert Apples, 3 dishes, distinct.
First Prize, 10*s.*; Second, 7*s.*
1. A. W. G. Wright, Esq., Newent (gr. W. H. Davies).
2. R. M. Whiting, Esq.

Class **39.**—Dessert Pears, 18 dishes, distinct.
First Prize, £3. 10*s.*; Second, £2.
1. Roger Leigh, Esq.
2. Earl of Ashburnham, Battle (gr. G. Grigg).

Class **40.**—Dessert Pears, 9 dishes, distinct.
First Prize, £1. 10*s.*; Second, £1.
1. J. R. Brougham, Esq., Carshalton (gr. W. Jones).
2. H. Partridge, Esq., Bletchingley (gr. J. W. Barks).

Class **41.**—Dessert Pears, 6 dishes, distinct.
First Prize, £1; Second, 15*s.*
1. A. Benson Esq., Merstham (gr. W. Mancey).
2. Madame Stuart.

Class **42.**—Dessert Pears, 3 dishes, distinct.
First Prize, 15*s.*; Second, 10*s.*
1. C. A. Morris Field, Esq., Sevenoaks (gr. R. Edwards).
2. W. A. Cook, Esq., Compton Bassett.

Class **43.**—Pears, 6 dishes, distinct, selected from the following varieties: 'Beurré Rance,' 'Easter Beurré,' 'Passe Crassanne,' 'Marie Benoist,' 'Knight's Monarch,' 'Le Lectier,' 'Doyenné d'Alençon,' 'Duchesse de Bordeaux,' 'Beurré Perran,' 'Olivier des Serres,' 'President Barabé.'
First Prize, £1. 10*s.*; Second, £1.
1. Roger Leigh, Esq.
2. Earl of Pembroke, Salisbury (gr. T. Challis).

Class **44.**—Cooking Pears, 3 dishes, distinct.
First Prize, 15*s.*; Second, 10*s.*
1. Roger Leigh, Esq.
2. Jeremiah Colman, Esq., Gatton Park (gr. W. P. Bound).

Class **45.**—Peaches, grown entirely out of doors, 1 dish of one variety.

First Prize, 10*s.*; Second, 7*s.*

1. Earl of Harrington.
2. R. C. Forster, Esq., J.P., Sutton (gr. W. Simpson).

Class **46.**—Nectarines, grown entirely out of doors, 1 dish of one variety.

First Prize, 10*s.*; Second, 7*s.*

1. Earl of Harrington.
2. R. Bedingfield, Esq., Roehampton (gr. J. Sparks).

Class **47.**—Plums, 1 dish of Dessert, of one variety.

First Prize, 7*s.*; Second, 5*s.*

1. Lord Braybrooke, Saffron Walden (gr. J. Vert).
2. Earl of Pembroke.

Class **48.**—Plums, 1 dish of Cooking, of one variety.

First Prize, 7*s.*; Second, 5*s.*

1. Mrs. Geo. Pearson, Brickendonbury (gr. R. Smith).
2. Earl of Harrington.

Division V.

Special District County Prizes.

Open to Gardeners and Amateurs only.

(In this Division all fruit must have been grown in the open.)

N.B.—Exhibitors in Division V. must not compete in Divisions II. and III., or in Classes 1, 2, 3, 4, 32, 33, 34, 37, 39, 40.

Class **AA.**—Apples, 6 dishes, distinct, 4 Cooking, 2 Dessert.

1st Prize, £1 and 3rd class Single Fare from Exhibitor's nearest railway station to London; 2nd Prize, 15*s.* and Railway Fare as above.

Class **BB.**—Dessert Pears, 6 dishes, distinct.

1st Prize, £1. 10s. and Railway Fare as above; 2nd Prize, £1 and Railway Fare as above.

The two above classes, AA and BB, are repeated eleven times as follows, and Exhibitors must enter for them thus: "Class AA 49," or "BB 50," and so on, to make it quite clear whether they mean Apples or Pears.

Class **49.**—Open only to Kent Growers.

AA.—Apples.
1. G. H. Dean, Esq., Sittingbourne (gr. W. T. Stowers).
2. A. Bailey, Esq., Farningham (gr. W. Elliott).

BB.—Pears.
1. G. H. Dean, Esq.
2. T. L. Boyd, Esq., Tonbridge (gr. E. Coleman).

Class **50**.—Open only to Growers in Surrey, Sussex, Hants, Dorset, Somerset, Devon and Cornwall.

AA.—Apples.
1. B. H. Hill, Esq., J.P., Crediton (gr. G. Lock).
2. J. K. D. Wingfield-Digby, Esq., M.P., Sherborne Castle (gr. T. Turton).

BB.—Pears.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. B. H. Hill, Esq., J.P.

Class **51**.—Open only to Growers in Wilts, Gloucester, Oxford, Bucks, Berks, Beds, Herts and Middlesex.

AA.—Apples.
1. A. W. G. Wright, Esq.
2. J. B. Fortescue, Esq., Maidenhead (gr. C. Page).

BB.—Pears.
1. Mrs. Ames, Westbury-on-Trym (gr. W. H. Bannister).
2. W. A. Cook, Esq.

Class **52**.—Open only to Growers in Essex, Suffolk, Norfolk, Cambridge, Hunts and Rutland.

AA.—Apples.
1. H. H. Hurnard, Esq., Hingham.
2. No award.

BB.—Pears.
1. Col. Archer Houblon, Bishop's Stortford (gr. W. Harrison).
2. Lord Braybrooke.

Class **53**.—Open to Growers in Lincoln, Northampton, Warwick, Leicester, Notts, Derby, Staffs, Shropshire and Cheshire.

AA.—Apples.
1. John Lee, Esq., Bebington.
2. H. Knott, Esq., J.P., Stamford (gr. J. Naylor).

BB.—Pears.
1. Duke of Rutland.
2. J. M. Clayton, Esq., J.P., Chesterfield (gr. W. Parkes).

Class **54**.—Open only to Growers in Worcester, Hereford, Monmouth, Glamorgan, Carmarthen and Pembroke.

AA.—Apples.
1. R. M. Whiting, Esq.
2. No award.

BB.—Pears.
1. G. H. Hadfield, Esq., Ross (gr. J. Rick).
2. H. L. Lutwyche, Esq., Ross (gr. J. E. Jones).

Class **55**.—Open only to Growers in the other Counties of Wales.

AA.—Apples.
1. Col. Cornwallis West, Denbigh (gr. H. Forder).
2. R. D. Hughes, Esq., Denbigh.

BB.—Pears.
1. Mrs. Davies-Evans, Llanbyther (gr. F. Fox).
2. Col. Cornwallis West.

Class **56**.—Open only to Growers in the Six Northern Counties of England, and in the Isle of Man.

AA.—Apples.
1. Col. Vaux, J.P., Sunderland (gr. C. Portsmouth).
2. Mr. J. Garside, Garstang.

BB.—Pears.
1. Sir Joseph Pease, Bart., M.P., Guisboro' (gr. J. McIndoe).
2. H. Thellusson, Esq., Doncaster (gr. W. Chuck).

Class **57**.—Open only to Growers in Scotland.

AA.—Apples.
1. Duke of Richmond and Gordon, Fochabers (gr. C. Webster).
2. C. A. Phillips, Esq., Douglas (gr. J. Culton).

BB.—Pears.
1. Earl of Galloway, Garliestown (gr. J. Day).
2. Duke of Richmond and Gordon.

Class **58**.—Open only to Growers in Ireland.

AA.—Apples.
1. Viscount Duncannon, Bessborough (gr. J. G. Weston). } Equal.
1. Mr. J. Orr, Loughgall. }

BB.—Pears. No entry.

Class **59**.—Open only to Growers in the Channel Islands.

AA.—Apples.
1. O. C. Knatchbull, Esq., Jersey (gr. J. Gavey).
2. No award.

BB.—Pears.
1. O. C. Knatchbull, Esq.
2. No award.

Division VI.

Single Dishes of Fruit Grown in the Open Air.

Open to Gardeners and Amateurs only. Nurserymen and Market Growers excluded.

Prizes in each Class (except 87, 88, 95, 106, 107, 117 and 143), 1st, 7*s.*; 2nd, 5*s.*

Choice Dessert Apples.

Class **60**.—Adams' Pearmain.
1. F. W. Thomas, Esq., Polegate.
2. H. H. Williams, Esq., Truro.

Class **61**.—Allen's Everlasting.
1. Roger Leigh, Esq.
2. No award.

Class **62**.—Allington Pippin.
1. Roger Leigh, Esq.
2. Earl of Pembroke.

Class **63**.—Blenheim Orange. (See Class 94.)
Small highly coloured Fruits which will pass through a 3-inch ring.
1. A. J. Carter, Esq., Billingshurst.
2. R. M. Whiting, Esq.

Class **64**.—Braddick's Nonpareil.
1. E. A. Lee, Esq., J.P., Liphook (gr. G. Hagon).
2. B. H. Hill, Esq., J.P.

Class **65**.—Brownlee's Russet.
1. T. L. Boyd, Esq.
2. Roger Leigh, Esq.

Class **66**.—Claygate Pearmain.
1. Roger Leigh, Esq.
2. R. M. Whiting, Esq.

Class **67**.—Cockle's Pippin.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. R. M. Whiting, Esq.

Class **68**.—Cox's Orange Pippin.
1. A. W. G. Wright, Esq.
2. { T. E. Pearce, Esq., Tavistock. / Lord Poltimore, Exeter (gr. T. H. Slade). } Equal.

Class **69**.—D'Arcy Spice, *syn.* Baddow Pippin.
No entry.

Class **70**.—Duke of Devonshire.
1. A. H. Smee, Esq.
2. G. H. Hadfield, Esq.

Class **71**.—Egremont Russet.
1. Roger Leigh, Esq.
2. R. M. Whiting, Esq.

Class **72**.—Fearn's Pippin.
1. G. H. Dean, Esq.
3. Duke of Fife, East Sheen (gr. S. Osborn).

Class **73**.—Gascoyne's Scarlet. (See Class 99.)
Small highly-coloured Fruits which will pass through a 3-inch ring.
1. G. H. Dean, Esq.
2. T. Clinch, Esq., Sittingbourne.

Class **74**.—Golden Reinette.
1. J. R. Brougham, Esq.
2. No award.

Class **75**.—King of the Pippins.
1. A. W. G. Wright, Esq.
2. Earl of Ashburnham.

Class **76**.—King of Tomkins County.
1. Roger Leigh, Esq.
2. Madame Stuart.

Class **77**.—Lord Burghley.
1. Capt. Forester.
2. Col. Cornwallis West.

Class **78**.—Mannington's Pearmain.
1. G. H. Hadfield, Esq.
2. Capt. Carstairs, Newbury (gr. C. Ross).

Class **79**.—Margil.
1. A. W. G. Wright, Esq.
2. G. H. Hadfield, Esq.

Class **80**.—Mother (American).
1. Lord Poltimore.
2. R. M. Whiting, Esq.

Class **81**.—Old Nonpareil.
1. Earl of Pembroke.
2. Col. Cornwallis West.

Class **82**.—Ribston Pippin.
1. H. Partridge, Esq.
2. Roger Leigh, Esq.

Class **83**.—Rosemary Russet.
1. Capt. Forester.
2 R. M. Whiting, Esq.

Class **84**.—Ross Nonpareil.
1. B. H. Hill, Esq., J.P.
2. C. J. Startup, Esq.

Class **85**.—Scarlet Nonpareil.
1. Roger Leigh, Esq.
2. Capt. Carstairs.

Class **86**.—Sturmer Pippin.
1. G. H. Dean, Esq.
2. H. Partridge, Esq.

Class **87**.—Winter Quarrenden.

First Prize, £1 ; Second, 10*s.* ; Third, 5*s.*

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1. F. W. Thomas, Esq.

2. } No award.
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AMERICAN BLACKBERRY KITTATINY. (*Journal of Horticulture.*)

FUNGUS PESTS OF THE CARNATION FAMILY.

By D. M. C. COOKE, M.A., LL.D., F.R.H.S., &c.

THE Carnation family may not be of overwhelming importance to horticulturists, but they seem to be of sufficient value to justify an attempt to bring together such information as may be available concerning the fungoid pests to which they are liable. With this view, and for this purpose, these parasites may be grouped superficially under four sections. Firstly, the leaf-spotting caused by such incomplete fungi as the Sphæropsideæ, and which seldom inflict greater injury than the destruction of the foliage, except perhaps in the allied forms of "anthracnose." Secondly, the less common but more destructive moulds—including in that term the "rot moulds," of the same kindred as the well-known Potato-disease. These consist of small white moulds, which cause little serious injury, and the black moulds, which, like the Tomato-leaf disease, are capable of inflicting such wholesale destruction. Thirdly, the smuts and rusts, or technically the *Ustilagineæ* and the *Uredineæ*; and fourthly, the obscure and mysterious group of Bacterial, or Microbe diseases, only recently taken into account.

Leaf-spotting is caused chiefly by small parasitic fungi, which consist of small flask-shaped conceptacles, called perithecia, enclosing minute spores, or conidia, which are expelled from an opening at the apex when mature, often in the form of tendrils, in which the spores are held together for some time as if by some tenacious gluten. These perithecia are usually gregarious, developed beneath the cuticle, on discoloured spots, such discoloration being caused chiefly by the mycelium of the perithecia. Each spot may contain three or four, or from thirty to forty perithecia, each so minute as to appear to the naked eye as the smallest black dot, sometimes almost if not quite inconspicuous. In the smaller group including "anthracnose," the perithecia are spurious and the spores are produced within similar-shaped cells, being extruded when mature from the perforated or ruptured apex.

The simplest form of leaf-spot is *Phyllosticta*, in which the spores are minute, and chiefly more or less elliptical. No British species has yet been met with on cultivated *Caryophyllaceæ*, although *Phyllosticta Dianthi* occurs in Belgium on Sweet William and in Britain on wild plants (fig. 1),* and *Phyllosticta tenerrima* in Canada on *Saponaria*. Another genus is *Ascochyta*, in which the chief difference lies in the spores being divided by a transverse septum into two cells. *Ascochyta Dianthi* is not uncommon in Britain, on leaves of *Dianthus* (fig. 2), as well as in the Netherlands and Germany. *Ascochyta Saponariæ* is at present confined to Germany. In the genus *Septoria* the spores are elongated, often very long and slender, nearly thread-like, and mostly septate. *Septoria Dianthi*, on Sweet William, is European (fig. 3), but not British. *Septoria Lychnidis* occurs in Britain, France, and Italy on

* In this paper the numbers refer to the several figures on the coloured plates.

Lychnis; *Septoria noctiflora* on *Silene* in the United States; *Septoria Sinarum* in Italy on *Dianthus sinensis*, and it has recently been observed in Britain; *Septoria dianthicola* on Sweet William, and Pinks and Carnations, in Italy and Portugal; *Septoria dianthophila* on fading stems of Carnations in Brazil; *Septoria Carthusianorum* on calyces of *Dianthus* in Belgium, where also *Septoria calycina* is recorded, if it be at all different; *Septoria Saponariæ* on *Saponaria*, in France, Britain (?), Italy and Germany; together with some half-dozen others upon uncultivated plants. In this connection there remain to be noticed those species in which the perithecia are suppressed, as in *Glœosporium Lychnidis*, which is the Carnation anthracnose of the Netherlands; *Marsonia Delastrei*, which is an anthracnose with septate spores (fig. 4) and occurs in France, Italy, Germany, Austria, and Siberia. Somewhat similar, but with long slender spores, is *Cylindrosporium Saponariæ*, found in France on *Saponaria* (fig. 17). The species of anthracnose, as they have been called, are much more destructive and disastrous than the simple leaf-spotting of the *Septoria* kind.

It is presumed that all these parasites of the first group, or *Sphæropsidæ*, are imperfect fungi; that is to say, that they are only early stages or conditions of more highly-developed fungi, in which the spores are produced in asci, and hence called ascomycetal. This is a problem which we are not called upon to solve here, but we must accept them as they are, and take such steps as we can for their identification, mitigation, and eradication. It is possible that in these cases the application of fungicides may be of good service, but it is only reasonable to suppose that the destruction of diseased leaves, as soon as possible after discovery, would diminish the chances for the spread of the disease, by getting rid of the reproductive bodies.

The diseases of the Carnation family that are caused by moulds are comparatively limited in number. Of the rot moulds, or *Peronosporiaceæ*, to which the Potato-disease belongs, only one or two species have been known to attack plants of this family. *Peronospora Dianthi* occurs on *Silene*, *Dianthus*, and *Agrostemma* (fig. 7) in France, Italy, Germany, Austria, and Switzerland; but, fortunately, is not yet recorded in Britain. There are three other species of the same genus, but hitherto they have only been found upon uncultivated plants, and only one of these, *Peronospora Arenariæ*, is British. We have called these "moulds," but they are of a higher and more complex organisation than the ordinary moulds, or *Mucedines*, which they only resemble, superficially, in form, and are more virulently parasitic.

The *Mucedines* are only represented by *Ramularia lychnicola*, which occurs on wild *Lychnis* (fig. 10), and has at present only been met with in the South of England; but it might make its appearance any day amongst Sweet Williams.

The black moulds have two representatives, of which the commonest, *Heterosporium echinulatum*, is well known as destructive to Carnations (fig. 6). It has been described in *Gard. Chron.* August 21, 1886, fig. 50, and previously in 1870, page 882. Not only has it been found in France and Switzerland, but is recorded for the Cape of Good Hope. It is worthy of note, in connection with this black mould, that small sclerotia

are to be found in the dying leaves. These sclerotia rest during the winter, and in the ensuing spring produce small conidia, which, on coming in contact with living leaves, will produce the mould. It must be borne in mind also that each cell of the mature normal conidia will germinate and produce a small secondary spore. The inference is that this is a dangerous parasite, because so persistent in the reproduction and continuation of the species that the destruction of all parts of diseased plants becomes imperative. The other black mould, *Macrosporium nobile*, is comparatively rare on Carnation leaves in the West of England (fig. 8). The large compound muriform conidia germinate from every one of its numerous cells.

The smuts, or *Ustilagines*, are known well enough on grasses and cereals, but are less obtrusive and less common on garden plants. The anther smut, *Ustilago violacea*, attacks the anthers of *Silene*, *Lychnis*, &c., giving the flowers the appearance of being dusted with soot (fig. 11), It is generally distributed throughout Europe, and reaches to the United States. The spores of this fungus are small and globose, becoming free. and not collected in clusters.

There are other smuts in which the spores are paler in colour, and collected in clusters or glomerules, more or less firmly attached to each other. One of these is called *Urocystis purpurea*, hitherto found only in the ovaries of *Dianthus* in Hungary, and consequently very little known. Another is *Sorosporium Saponariæ*, found on the floral organs of *Saponaria*, *Dianthus*, *Stellaria*, and *Lychnis*, in Britain, France, Germany, Austria, Italy, and Algeria. The glomerules consist of a great number of normally globose or elliptical spores (fig. 9), which become angular by compression, of an ochrey colour, with the external surface rough or warted. When quite mature these spores separate, and each germinates on its own account. Another species has been described under the name of *Sorosporium Dianthi*, said to occur on *Dianthus prolifer* in Italy, but possibly it is the same species as the foregoing, as it presents no distinctive characters. These, so far as I am aware, are the only smuts which have been recorded for the Carnation family, and in all cases are developed in the flowers, and do not affect the foliage.

We now arrive at the group of Fungus Pests which are known to cultivators as cluster-cups, rusts, and brands, but to science as *Uredines*. For all practical purposes it seems better to treat all the forms as they appear to the eye, and as in former times they were regarded by botanists, as distinct entities or species. The cultivator desires to recognise them and give them their names, without troubling himself as to their genetic relations, or only collaterally so. To him the cluster-cup appeals as a cluster-cup, and not as a form or condition of a rust, or a brand, a *Uredo* or a *Puccinia*. Whether this course is scientifically accurate we do not stay to inquire, so long as we are convinced that it is the most convenient, and is used in a popular sense, without prejudice to any real or imaginary life-histories. Take an extreme case—the cultivator will be more satisfied to call the cluster-cups of the Barberry by its old name of *Æcidium Berberidis*, rather than æcidiospores of *Puccinia graminis*, supposing even that he accepts their genetic relationship.

Cluster-cups are not common amongst the cultivated species of the *Caryophyllaceæ*, of which *Æcidium Behenis* (fig. 12) is a representative, and the *Uredo* forms are usually mixed with, or growing in company with, the brands. Of the latter are two kinds, those in which the teleutospores, or final spores, are one-celled, as *Uromyces*; and those in which they are two-celled, as *Puccinia*. The former are represented on *Silene* and *Dianthus* by *Uromyces Silenes* in Italy, Germany, Hungary, and Asiatic Siberia (fig. 14), but not in Britain; also by *Uromyces caryophyllinus* on *Dianthus* in Italy, Germany, Moravia, Tyrol (fig. 13), and sometimes in Great Britain, but not as a troublesome pest. An allied species, with rough spores, named *Uromyces sinensis*, occurs on *Dianthus sinensis* in Italy. Another species, *Uromyces Gypsophilæ*, with large rough globose teleutospores, has only been found on leaves of *Gypsophila* in Kurdistan.

The two-celled brands, or *Puccinia*, are far more common, and the one which is so destructive to Sweet William, and other species of *Dianthus*, *Stellaria*, *Mœhringia*, and *Agrostemma*, has been called *Puccinia Lychnidearum* or *Puccinia Dianthi*. The tufts are clustered in a circinate manner upon pallid spots, and the teleutospores are long and narrow (fig. 5). It occurs throughout Europe and the United States of America. Another species on *Silene* has shorter and broader teleutospores, and is called *Puccinia Silenes*, which has been found in Britain, France, Belgium, Italy, Germany, Switzerland, and Asiatic Siberia (fig. 15). Still another species, perhaps confined to Siberia, occurs upon the foliage of *Dianthus sinensis*, and is known as *Puccinia fastidiosa*. The teleutospores are larger than in the last named, with an apiculus, or nipple, at the apex (fig. 16). Several other species, or forms, occur upon the leaves of uncultivated plants, belonging to this family, which need not to be enumerated here.

In all the species of *Uredo*, *Uromyces*, and *Puccinia* the spores are produced upon a kind of stroma, or cushion, beneath the cuticle, and as the spores enlarge and approach maturity they elevate and ultimately burst the cuticle, the remains of which surround the tuft, or sorus, which is sometimes nearly orbicular, at others elliptical, and occasionally much elongated. When the cuticle is ruptured, the spores being mature escape, in most instances, as a rust-coloured, brown, or nearly black powder. In some cases, however, the pustules remain compact, and the spores do not readily escape, or at least not for a considerable time after the rupture of the cuticle. It will be observed also that in some species the pustules, or sori, are scattered over the surface of the leaf, upper or under, and sometimes are clustered together in some definite manner. By observing these features considerable aid is given towards the determination of species, even before examining the spores under the microscope; but the final test is found in the form, size, and character of the spores, as revealed by the microscope.

The only remaining pests to be alluded to are those mysterious ones in which microbes are believed to be concerned. This subject was fully discussed in an article on "Bacteriosis of Carnations" in the *Gardeners' Chronicle* two or three years ago. On that occasion it was shown that a disease affecting Carnations in the United States had been demonstrated

by Professor Arthur to have been caused by a minute organism, to which he had given the name of *Bacterium Dianthi*. Although there had been grounds for suspicion, it was also stated that no direct evidence had been obtained of the presence of the disease in this country. It must be confessed that, down to the present time, no further evidence has been forthcoming of the existence of bacteriosis in Carnations in Great Britain.

Practical men will at once inquire for remedies or preventives of these diseases, and expect, perhaps, to be referred to some panacea which will cure all the diseases that plants are heirs to, albeit that such a thing has not been discovered, and never will be. The first step must be to obtain a true diagnosis of the disease, and then apply such remedies as have been found to be successful in similar cases. It cannot be repeated too often that plant-diseases are of two kinds, which have been called *epiphytic* and *endophytic*. *Epiphytic* are those diseases which attack the plant externally, like the Hop-mildew and the Maple-blight, which appear first on the surface of the leaves, and then penetrate the tissues. Such diseases naturally are exposed to the action of fungicides, and can be acted upon direct, with a fair prospect of success. *Endophytic* parasites, on the contrary, are more insidious, and attain a considerable internal development before the plant exhibits externally any evidence of their presence. When such kinds of pests show themselves in the foliage the mischief has been done, and the plant has become more or less permeated by the mycelium of the parasite. Unfortunately, the greatest number of plant-parasites are *endophytic*, but whilst it is almost hopeless to do much good with fungicides to eradicate, much may be done to prevent the spread of the disease. Horticulturists in these latter days are too well acquainted with the ordinary fungicides and the methods of spraying to need much instruction. But are they sufficiently impressed with the necessity for destroying all infected leaves or stems, and with them all germs of the disease, so as to help in stamping it out?

List of Parasites on Caryophyllaceæ, whether Cultivated or Uncultivated.

Phyllosticta tenerrima, E. & E., on leaves of *Saponaria*, Canada.

Phyllosticta Saponariæ, Fckl., on leaves of *Saponaria*, Italy and Germany.

Phyllosticta nebulosa, Sacc., on *Silene pendula*, Italy.

Phyllosticta Dianthi, West, on *Dianthus barbatus*, Belgium.

Ascochyta Saponariæ, Fckl., on leaves of *Saponaria officinalis* Germany.

Ascochyta Dianthi, A. & S., on leaves of *Dianthus*, in Britain, Germany.

Septoria Carthusianorum, West, on calyces of *Dianthus Carthusianorum*, Belgium.

Septoria Dianthi, Desm., on leaves of *Dianthus barbatus*, *Armeria* and *Saxifraga*, in France, Italy, Portugal, Siberia.

Septoria Saponariæ, DC., on leaves of *Saponaria* and *Silene inflata*, Italy, France, Germany, and Britain.

Septoria silenicola, Ell. & Mart., on leaves of *Silene stellata*, Pennsylvania, U.S.A.

Septoria Silenes, West, on leaves of *Silene Armeria*, Belgium.

Septoria dimera, Sacc., on leaves of *Silene nutans*, France.

Septoria dianthicola, Sacc., on leaves of *Dianthus barbatus* and *D. Caryophyllus*, in Portugal.

Septoria Sinarum, Speg., on leaves of *Dianthus sinensis*, in Italy and Britain.

Septoria calycina, Kickx, on calyces of *Dianthus Carthusianorum*, Belgium.

Septoria Lychnidis, Desm., on leaves of *Lychnis dioica*, in Britain, France, and Italy.

Septoria Melandrii, Pass., on leaves of *Lychnis vespertina* and *L. diurna*, Italy.

Septoria Stellariæ, Rob. & Desm., on leaves of *Stellaria media* and *S. cerastioides*, France, Italy, Siberia, and Britain.

Septoria Stellariæ nemorosa, Roum., on leaves of *Stellaria nemorum*, France.

Septoria Cerastii, Rob. & Desm., on leaves of *Cerastium vulgatum* and *C. trivialis*, Italy, Belgium, France, and Britain.

Septoria dianthophila, Speg., on stems of *Dianthus Caryophyllus*, in Brazil.

Glœosporium Lychnidis, Oud., on leaves of *Lychnis diurna*, Netherlands.

Marsonia Delastrei, De Lac., on leaves of *Lychnis dioica*, *Agrostemma*, *Silene*, in France, Germany, Italy, Austria, Siberia.

Cylindrosporium Saponariæ, on leaves of *Saponaria officinalis*, France.

HYPHOMYCETES.

Ramularia lychnicola, Cke., on *Lychnis diurna*, Britain.

Heterosporium echinulatum, Berk., on *Dianthus*, Britain, Switzerland, France, Belgium.

Macrosporium nobile, Vize, on leaves of *Dianthus*, Britain.

HYPODERMEI.

Ustilago Duriæana, Tul., in ovules of *Cerastium*, Germany.

Ustilago violacea, Pers., on anthers of *Silene*, *Viscaria*, *Dianthus*, *Saponaria*, and *Stellaria*, in Britain, France, Italy, Germany, Switzerland, Austria, Belgium, North America.

Ustilago Holostei, DBy., on anthers and ovaries of *Holosteum umbellatum*, in Germany.

Sorosporium Saponariæ, Rud., on ovaries, &c., of *Dianthus*, *Saponaria*, *Silene*, *Stellaria*, *Lychnis*, *Cerastium*, &c., in Germany, Austria, France, Italy, Britain, Algeria.

Sorosporium Dianthi, Rab., on flowers of *Dianthus proliferus*, Italy.

Urocystis purpurea, Hazl., on ovaries of *Dianthus deltoides* and *D. proliferus*, in Hungary.

Uromyces Silenes, Schl., on leaves of *Silene nutans* and *Dianthus Armeria*, in Italy, Germany, Hungary, and Siberia.

Uromyces caryophyllinus, Schr., on leaves of *Dianthus superbus*, *proliferus*, *Caryophyllus*, and *Gypsophila*, in Tyrol, Moravia, Italy, Germany, and Britain.

Uromyces Schrœteri, De Toni, on leaves of *Melandrium* and *Cucubalus*, in Germany.

Uromyces sparsus, K. & S., on leaves of *Stellaria*, &c., Britain, Belgium, Germany.

Uromyces cristatus, Schr., on leaves of *Viscaria* and *Dianthus Armeria*, Moravia.

Uromyces Behenis, DC., on leaves of *Silene inflata*, &c., in Britain, France, Italy, Austria, Germany, Hungary.

Uromyces Gypsophilæ, Cke., on leaves of *Gypsophila*, Kurdistan.

Uromyces sinensis, Speg., on leaves of *Dianthus sinensis*, Italy.

Melampsorella Cerastii, Pers., on leaves of *Stellaria* and *Cerastium*, Italy, France, Austria, Hungary, Germany, Netherlands, Finland, Britain, and N. America.

Puccinia Silenes, Schr., on leaves of *Silene* and *Melandrium*, in Italy, France, Belgium, Germany, Switzerland, and Britain.

Puccinia Arenariæ, Schum., on leaves of *Dianthus*, *Saponaria*, *Melandrium*, *Agrostemma*, *Alsine*, *Arenaria*, *Stellaria*, *Cerastium*, &c., in Italy, France, Belgium, Austria, Switzerland, Germany, Britain, Portugal, Finland, Siberia, N. America.

Puccinia hysteriiformis, Peck., on leaves of *Arenaria verna*, Utah, U.S.A.

Puccinia fragilis, Tracy, on leaves of *Arenaria pungens*, Nevada, U.S.A.

Puccinia fastidiosa, Sacc., on leaves of *Dianthus sinensis*, Siberia.

Æcidium Cerastii, Wint., on leaves of *Cerastium nutans*, U.S.A.

Æcidium gregarium, Hazl., on leaves of *Silene noctiflora*, Sclavonia.

Æcidium Otitis, Schl., on leaves of *Silene Otitis*, Germany.

Æcidium sparsum, Hazl., on leaves of *Silene viridiflora*, Hungary.

Æcidium Stellariæ, Kirch., on leaves of *Stellaria graminea*, Bohemia.

Æcidium Behenis, DC., on leaves of *Silene*, &c., Britain, and other parts of Europe.

Peronosporaceæ.

Peronospora Alsinearum, Casp., on *Cerastium*, *Stellaria*, *Alsine*, &c., in Italy, Belgium, France, Germany.

Peronospora Dianthi, DBy., on leaves of *Silene*, *Melandrium*, and *Agrostemma*, Germany, Italy, Switzerland, and Austria.

Peronospora Arenariæ, Berk., on leaves of *Arenaria*, Germany, Britain, Belgium, France.

Peronospora Holostei, Casp., on leaves of *Holosteum umbellatum*, Germany.

Ascomycetes.

Pseudopeziza Cerastiorum, Wallr., on leaves of *Cerastium* and *Stellaria*, Germany, Italy, Belgium, France, Britain.

Pyrenopeziza Agrostemmatis, Fckl., on fading leaves of *Agrostemma*, in Germany.

Sphærella isariphora, Desm., on leaves of *Stellaria graminea* and others, in Britain, France, Germany, Italy, Belgium, Finland.

SCHIZOMYCETES.

Bacterium Dianthi, A. & B., on leaves of Carnation, *Dianthus plumarius, japonicus, chinensis*, and *barbatus*, North America.
Sixty species.

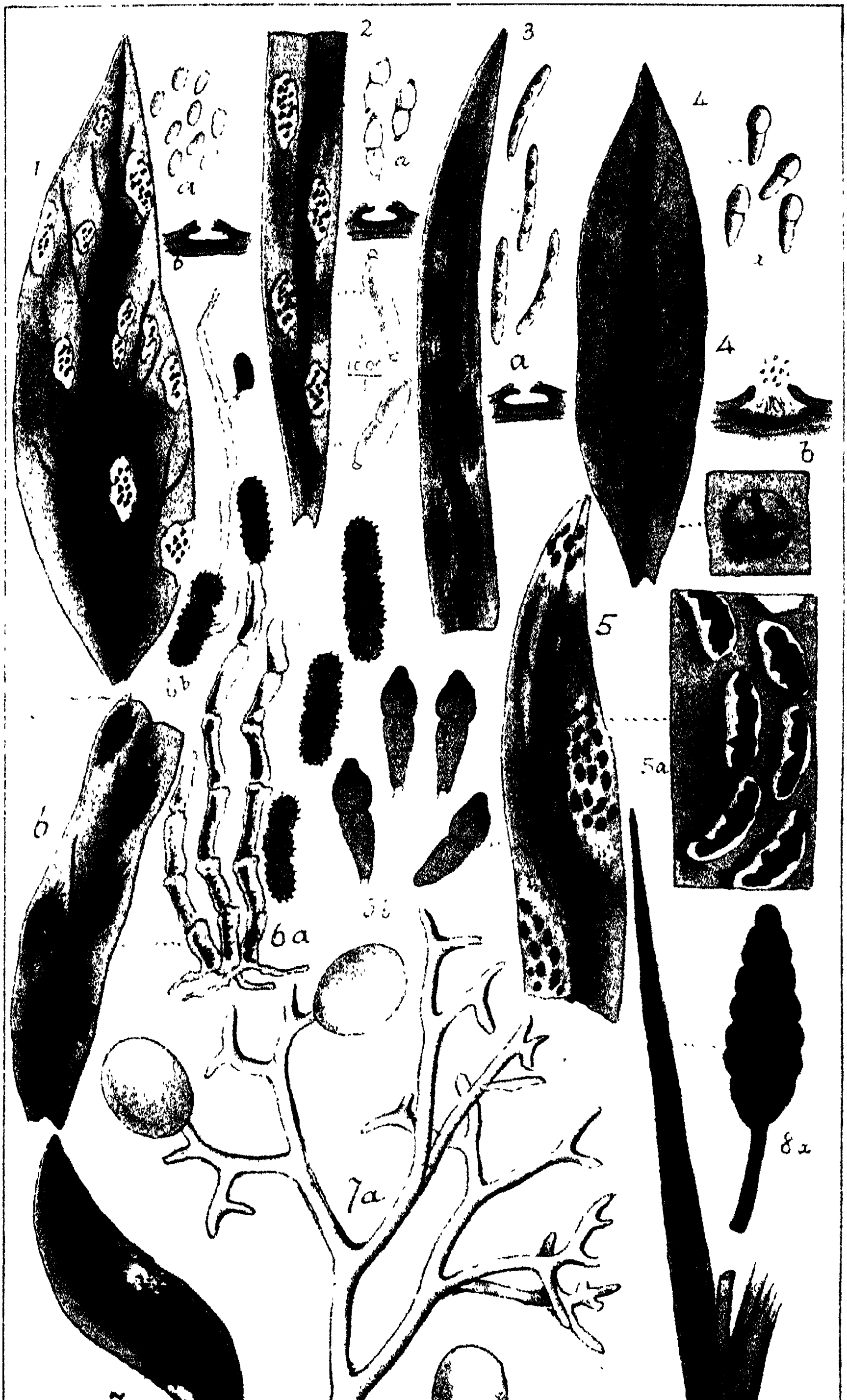
EXPLANATION OF PLATES.

PLATE I.

FIG. 1.—*Phyllosticta Dianthi*, West.—*a*, conidia × 320; *b*, section of perithecium, enlarged.
2.—*Ascochyta Dianthi*, A. & S.—*a*, conidia × 330, with section of perithecium; *b*, conidia × 1,000.
3.—*Septoria Dianthi*, Desm.—*a*, conidia × 320.
4.—*Marsonia Delastrei*, De Lac.—*a*, conidia × 320; *b*, exterior of pustule, and section, enlarged.
5.—*Puccinia Dianthi*, DC.—*a*, cluster of sori, enlarged; *b*, teleutospores × 320.
6.—*Heterosporium echinulatum*, Berk.—*a*, hyphæ and conidia; *b*, germinating conidia × 320.
7.—*Peronospora Dianthi*, DBy.—*a*, hyphæ and conidia.
8.—*Macrosporium nobile*, Vize.—*a*, conidium × 350.

PLATE II.

9.—*Sorosporium Saponariæ*, Rud.—*a*, spore in germination × 320.
10.—*Ramularia Lychnicola*, Cooke.—*a*, hyphæ and conidia; *b*, conidia × 320.
11.—*Ustilago violacea*, Pers.—*a*, spores × 320.
12.—*Æcidium Behenis*, DC.—*a*, cups enlarged; *b*, section; *c*, æcidiospores × 320.
13.—*Uromyces caryophyllinus*, Schr. *a*, uredospores; *b*, teleutospores × 320; *c*, sorus, enlarged.
14.—*Uromyces Silenes*, Fckl.—*a*, uredospores; *b*, teleutospores × 320; *c*, sori, enlarged.
15.—*Puccinia Silenes*, Schr.—*a*, sori, enlarged; *b*, uredospores; *c*, teleutospores × 320.
16.—*Puccinia fastidiosa*, Sacc. Teleutospores × 320.
17.—*Cylindrosporium Saponariæ*, Rom.—*a*, hyphæ and conidia × 320.


1
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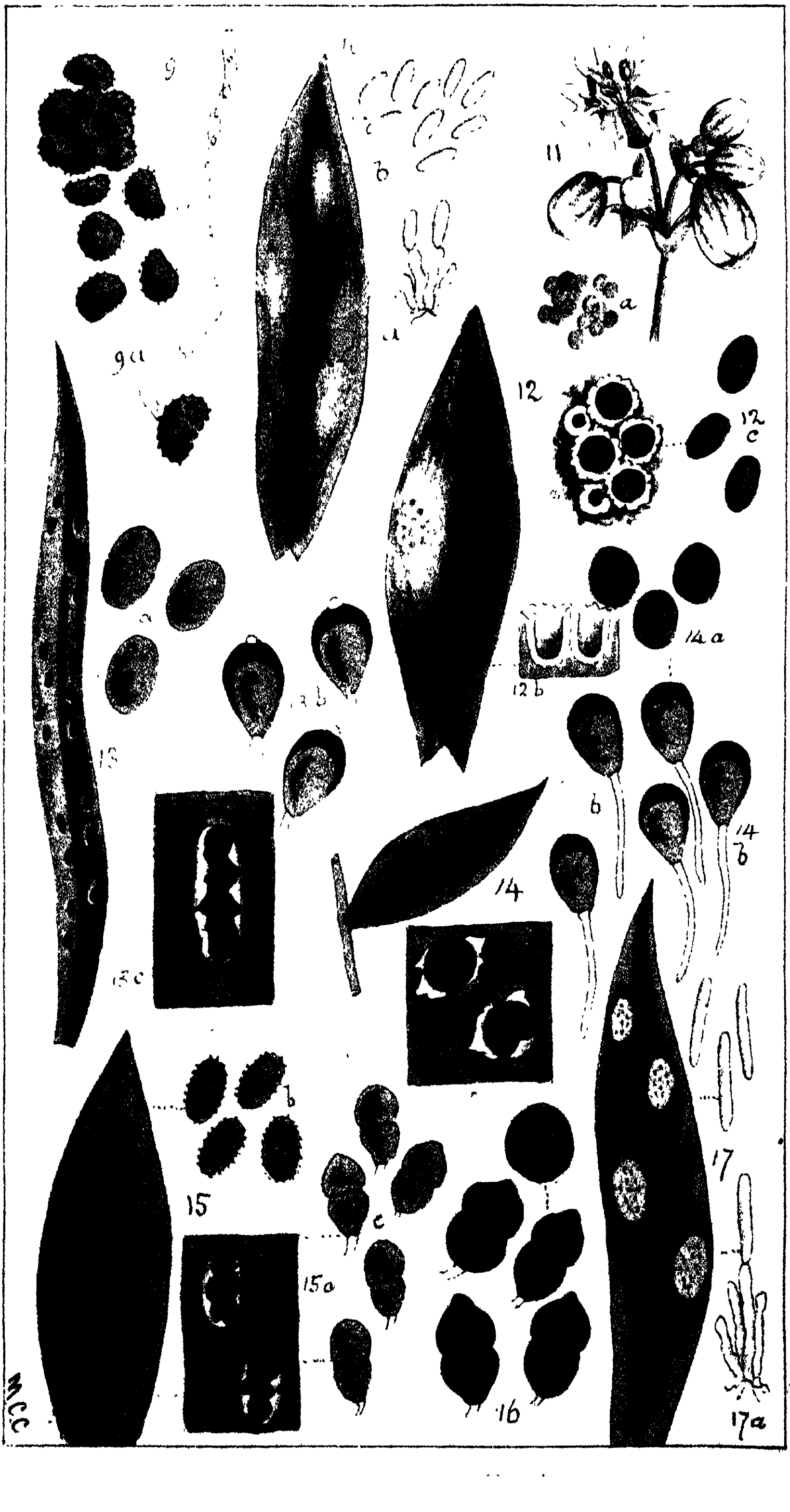
9
9a
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HARDY FRUIT IN THE NORTH OF SCOTLAND.

By DONALD MACLEAN, F.R.H.S., Caithness.

[Read October 15, 1901.]

NOTWITHSTANDING the severity of our climate in the far North, a great deal can be accomplished by care and knowledge in growing hardy fruits successfully. One of the greatest hindrances is the want of shelter. I refer more especially to the county of Caithness, where, owing to the total want of mountain shelter along the east and north, the inclemency of the weather is felt more severely in winter and spring than in the neighbouring counties of Sutherland and Ross. There is also the want of forest-tree shelter, as forest-tree planting has been very much neglected in Caithness on the presumption that forest trees will not grow to any size; but I think that there is ample evidence to show, by what have been already planted, that if properly treated they would do fairly well, and, while affording shelter for man and beast, would also add very much to the beauty of the landscape.

The cultivation of good fruit requires the utmost attention and forethought from the gardener. The introduction of a worthless culinary annual or perennial vegetable into a garden is a trivial loss compared to the introduction of a worthless fruit tree. The one only disappoints for a season, the other for a number of years. The one can be rectified perhaps the same year, and if not, certainly in the succeeding one, but the other takes some years to arrive at that perfection which will enable one to judge of its merits. The disappointment is therefore great when, instead of being repaid for years of anxious care by possessing a fine fruit, we find it at last to be perhaps of even less merit than any other in the garden. We have, therefore, to study particularly those varieties that do best in this rather fickle climate.

The winds blow west or north-west during three-fourths of the year, and frequently rise into strong gales in winter, spring, and autumn. The prevailing wind from the beginning of May till the end of June is usually from the north-west, and from the end of June till September is variable from south-west to south-east, but seldom from the north. During this season vegetation makes perhaps a more rapid progress than it does in counties enjoying a better climate. This may be accounted for by the check given to vegetation in May. In part also it may be due to the longer hours of sunlight which we have at midsummer in the far North.

The soil is a dark and, in some parts, a clayey loam, well adapted for agriculture, which is carried on with as much skill and success as in any other part of Scotland.

Standard or pyramid fruit trees of the Apple, Pear, Plum, and Cherry are not found profitable here; in fact, they should not be attempted, as, on account of the biting winds, all such fruits require the shelter of good high walls. South walls fourteen feet high are the most suitable; and trees that are well attended to give splendid results on them.

'Beauty of Kent' is the Apple which seems to do better than any

other. Fruit weighing 17 oz. has been gathered from this variety, and this last season (1901) the same trees have borne a fine crop of Apples, with a good percentage weighing 14 oz. each. The varieties that do next best are: 'Irish Peach,' 'Duchess of Oldenburg,' 'Pineapple Russet,' 'Hawthornden,' and 'Court of Wick.'

The Pears that do best are: 'Early Beurré,' 'Souvenir du Congrès,' 'Marie Louise,' 'Gansel's Bergamot,' and 'Alexander Bivort.'

The best Plums are: 'Denniston's Superb,' 'Jefferson,' and 'Purple Gage.'

The best Cherries are: 'May Duke,' 'Kentish,' and 'Morello.' The 'May Duke' Cherry is the first fruit to ripen with us, and it is generally ready in the beginning of June.

Raspberries are always a good crop. The same can be said of Gooseberries, and of Black, White, and Red Currants.

The Strawberries that we find to do well are: 'Royal Sovereign,' 'A. F. Barron,' 'President,' 'Sir Joseph Paxton,' 'Elton Pine,' and 'Latest of All.' Of 'Royal Sovereign' we have gathered fruits weighing $2\frac{1}{2}$ oz. each, and this season they were ripe on the 8th of July.

The Peach, Apricot, and Nectarine we do not consider hardy in this part, but we have seen them do remarkably well as far north as the county of Inverness.

The following is a note of the temperature recorded here during the first three months of this year (1901):—

January	Min. deg.	Max. deg.	February	Min. deg.	Max. deg.	March	Min. deg.	Max. deg.
1	32	35	1	32	45	1	35	50
2	33	38	2	30	48	2	36	49
3	30	42	3	36	49	3	35	52
4	31	37	4	31	43	4	32	50
5	29	35	5	36	47	5	30	49
6	28	38	6	32	50	6	36	53
7	26	38	7	29	48	7	35	51
8	29	41	8	29	49	8	39	50
9	29	39	9	30	50	9	30	45
10	30	40	10	33	50	10	32	47
11	31	39	11	34	48	11	30	51
12	30	36	12	35	52	12	35	53
13	28	33	13	36	49	13	34	49
14	26	35	14	31	45	14	32	47
15	25	38	15	30	47	15	31	51
16	28	35	16	33	49	16	30	48
17	32	40	17	29	47	17	28	43
18	26	35	18	28	49	18	30	50
19	29	39	19	31	50	19	29	45
20	34	38	20	28	45	20	28	46
21	35	40	21	29	47	21	30	51
22	32	40	22	30	49	22	31	48
23	30	37	23	33	50	23	28	42
24	31	35	24	34	49	24	21	47
25	30	36	25	33	51	25	22	46
26	25	38	26	32	47	26	20	45
27	32	35	27	32	49	27	17	42
28	31	37	28	30	47	28	28	48
29	33	40				29	29	50
30	32	36				30	30	45
31	28	37				31	32	49

As will be seen from the above table, fifteen degrees of frost was the hardest we experienced during these three months, and I think that this

table gives a very fair average for a number of years back. Farther inland the frosts are much more severe, but being on the north-east coast we get more of the scorching winds, which, together with late frosts, are very troublesome for wall-fruit. To prevent injury we cover our wall-trees with canvas screens, which, while they break the force of the winds, do not prevent a quantity of light from penetrating to the trees. The cloth for these screens is very light, being made of tiffany; and if attended to with respect to their being put on and taken off at the proper times, they add very much to the fruitfulness of the wall-trees. Small fruits, such as Currants, Gooseberries, Raspberries, Strawberries, &c., are seldom, if ever, affected by the late frosts here.

Hardy fruit culture in this county has not received the attention that it deserves, especially amongst the farmers and crofters; but it is gratifying to note that there is a steady progress being made; and now the half of their kailyards is generally given up for the growth of Raspberries, Gooseberries, Currants, and Strawberries.

The counties of Sutherland and Ross I do not know so well; but, the climate being much better than it is here, it stands to reason that, if attended to, hardy fruit will thrive there better. Inverness-shire I know well, and the hardy fruits grown there will compare favourably with any grown in Scotland.

CHRYSANTHEMUM 'SOUVENIR D'UNE PETITE AMIE.' (*The Garden.*)

BEST HARDY FRUITS FOR CENTRAL SCOTLAND.

By William Wright, Perthshire.

[Read October 15, 1901.]

Fruit culture in the central districts of Scotland is an important and increasing industry. At present there are probably several hundred acres under Apples, Bush Fruits, and Strawberries, and good paying crops are generally the result. As a rule the soil and climate are well suited for the purpose, and though very liable to cold and frosty nights in late spring, when the trees are in flower, if these pass off without damaging the blossom there is nothing more to be dreaded.

Generally speaking, fruit culture is carried out on up-to-date principles, and though there are many old orchards and obsolete varieties of Apples which only produce inferior crops, these are generally disposed of to the jam manufactories, and even so they pay tolerably well in ordinary seasons.

Apples, being perhaps the most important crop, may be taken first. These are grown as cordons on walls, and edging to walks, bush, pyramid and half standards in gardens, and standards for orchards.

Dessert Varieties.—Among the most suitable are 'Irish Peach,' which does well; 'Beauty of Bath,' very free and good; 'Lady Sudeley,' good, and colours well; 'Red Astrachan,' very useful; 'Thorle Pippin,' a good old variety; 'Kerry Pippin' is apt to canker on some soils; 'Worcester Pearmain,' one of the best croppers; 'King of the Pippins,' the most useful winter variety; 'James Grieve,' a good cropper and grower, and takes the place of 'Ribston Pippin,' which does poorly, and requires a wall here; 'Cox's Orange' does not crop well unless root-pruned occasionally. Others that do well and are generally grown are 'Oslin Pippin,' 'Adams' Pearmain,' 'Fearn's Pippin,' 'Paradise Pippin' (useful when others are scarce), 'Devonshire Quarrenden,' 'Sturmer Pippin' (requires a wall here), 'Blenheim Orange' (makes an excellent tree, and bears well as a standard).

Kitchen Varieties.—'Bramley's Seedling,' good and free, but rather long in coming into bearing condition; 'Duchess of Oldenburg,' free and good; 'Lord Suffield,' cankers in light gravelly soils, and where this happens 'Lord Grosvenor' is better; 'Stirling Castle,' a heavy cropper and good; 'Warner's King,' best on standard trees, and keeps well; 'Keswick Codlin,' a sure cropper; 'Pott's Seedling,' reliable and good; 'Cellini,' apt to canker sometimes; 'Ecklinville,' a grand cropper; 'Golden Spire,' good; 'Northern Greening,' very reliable and good; 'Ringer,' excellent; 'Hawthornden,' a very old favourite. Other good ones are 'Alfriston'; 'Dumelow's Seedling,' liable to canker; 'Lane's Prince Albert,' very good; 'Yorkshire Beauty,' useful and a free doer; 'Tower of Glamis'; 'The Queen,' and 'Golden Noble.'

Pears are usually grown on walls, but some varieties do well as pyramids, cordons, and standards. 'Autumn Bergamot,' 'Hessle,' 'Muirfowl Egg,' 'Doyenné d'Eté,' 'Crawford,' and 'Catillac' all do well, and crop heavily as a rule as standards. But we must rely on walls for our best dessert Pears. The following usually crop and finish well:— 'Jargonelle,' 'Williams' Bon Chrétien,' 'Beurré d'Amanlis,' 'Beurré Diel,' 'Louise Bonne of Jersey,' 'Doyenné du Comice,' 'Marie Louise,' 'Gansel's Bergamot,' and 'Easter Beurré.'

Plums crop and do well as a rule. Several may be grown as bush, pryamid, and standards. The best for this purpose are 'Victoria,' 'Orleans,' 'Jefferson,' and 'Goliath.' For walls the following are reliable:—'Coe's Golden Drop,' 'Early Transparent Gage,' 'Green Gage,' 'Pond's Seedling,' 'Kirke's,' 'Cox's Emperor,' 'Diamond,' 'Early Prolific,' 'Prince Englebert,' 'Jefferson' (one of the best), 'Ickworth Impératrice,' and 'Washington.' 'Victoria' is best on a wall if it is to be used for dessert.

Cherries are grown only on walls, and the following all do well and crop heavily:—'Early Rivers,' 'May Duke,' 'Governor Wood,' 'Black Eagle,' 'Late Duke,' and 'Archduke.' The Bigarreaus do not do well, as they crop but sparingly. For kitchen use, 'Morello' and 'Kentish' bear heavy crops generally.

Peaches are not extensively grown out of doors, owing to the precarious spring weather when they are in flower, and they usually suffer badly from leaf blister. The following, however, will ripen perfectly outside on a wall in ordinary seasons:—'Hale's Early,' 'Early York,' 'Waterloo,' 'Alexander,' and 'Early Beatrice.'

Nectarines and *Figs* cannot be recommended for outdoor culture, as they will not ripen as a rule outside.

Apricots do well in some places, but are not reliable; sometimes half a tree will die without any apparent reason.

Small Fruits.—In these we can compare favourably with southern growers, owing to our cool and moist climate. Nowhere have I seen finer Raspberries, Strawberries, or Bush Fruit than in Perthshire and Stirlingshire. Raspberries delight in a moist border facing north, where they bear heavy crops and make canes 6 ft. and 9 ft. high. 'Superlative' is no doubt the best Raspberry. Strawberries also do well, but it is useless to recommend varieties, because what does well here is often useless a few miles away; so the only plan is to try what varieties will suit the soil, and not to plant large quantities until you see what will do best. Gooseberries are very largely grown for marketing near towns and are a profitable crop. 'Whinham's Industry,' 'Whitesmith,' and 'Warrington' are largely grown for market, but 'Whinham's' is the best of all for weight of crop. By planting dessert varieties on a north or east wall, we get late ripe fruit for the end of August and the first week or two in September. Black Currants are also largely grown for market, but the mite has made terrible havoc in many places, and no reliable remedy is known. Cutting down and burning old bushes affected is not much good, as the young growth is as bad as ever in a year or two.

THE BEST HARDY FRUITS FOR SOUTHERN SCOTLAND.

By JAMES DAY, Wigtownshire.

[Read October 15, 1901.]

THE following remarks upon the subject of hardy fruit culture, and the varieties which succeed well in Scotland, may prove somewhat tedious; for in order to emphasise those varieties which possess the important characteristics of (i) robust constitution, (ii) general freedom from disease, and (iii) are good and constant bearers, it will be often necessary to repeat names which have now become familiar in every fruit-growing district throughout Great Britain.

In the first place I may say that the practical part of my work, and the experience of the good qualities or otherwise of the varieties referred to, I have gained chiefly in the southern part of Scotland—more particularly in the province of Galloway. This province lies in close proximity to the sea, and has, in proportion to its area, a very great extent of coast-line, which is washed by the waters of the Gulf Stream, whose genial influences are imparted to it, rendering the climate both mild and moist, and therefore generally favourable to the successful cultivation of hardy fruits.

The soil, which has perhaps a greater bearing even than climate upon the success or otherwise of fruit culture, varies greatly in different parts. The uplands which rise to a considerable height are very bleak and cold, and are mostly composed of a substratum of rock, the outcrop of which is in many parts so prominent as to preclude the possibility of any form of cultivation. Almost equally unsuitable are the vast stretches of peat or bog land, which, being generally destitute of fibre and at all times too retentive of moisture, favour a soft, sappy growth, which, in the case of Apples and Pears, speedily falls a prey to canker and kindred evils. Bush fruits and Raspberries, however, will sometimes thrive very well, and yield heavy crops for a number of years on soil of this nature.

This doleful description of soil happily applies only to a certain portion of the district, the greater part being of an entirely different character, possessing both depth and quality, and having in most cases good natural drainage, which renders the working of the land a comparatively easy matter; consequently, with the provision of shelter from the winds of spring (which, by the way, often work more damage than frost), most kinds of hardy fruits succeed well, and the produce from them, provided that the necessary time and attention are given to cultivation, is but little inferior to the best examples raised under conditions which, for climate and latitude, are usually looked upon as much more favourable.

Very little, however, of the land in this part, except in the vicinity of the towns or that used as private gardens, is under fruit cultivation. The sparse population and the great distance from the large centres of industry probably account to some extent for this; while the ever-

increasing interest that is taken in dairy-farming and stock-raising shows that the occupiers strive to combat the agricultural depression in this way rather than in fruit-growing, which has become so general in more populous parts of the country. Hence but little change or progress during recent years in fruit cultivation can be reported.

Commencing with Apples, which here, as elsewhere, are recognised as the most useful of hardy fruits, their cheapness generally, and the long period during which they may be obtained, even by the poorest classes, give them a value above all others. As may be expected, most of the older trees are grafted upon the Crab stock, but the introduction of the English paradise has proved a boon to most gardens, especially to those where space for large spreading trees cannot be afforded. The latter stock succeeds well in this district, and handsome and fruitful trees are very soon produced. It will be unnecessary to give a long list of the names of all the varieties grown, as it would include many scarcely worthy of cultivation. I shall therefore mention, in their order of ripening, only the best and most constant bearers, which have proved reliable for giving a good and plentiful supply of fruit for a long season.

Dessert Apples.—For earliest use I have found none to equal 'Mr. Gladstone,' which seldom fails to bear a full crop, and the size, colour, and quality of the fruit are always good for an early variety. It usually ripens upon bush trees early in August.

To succeed this, 'Beauty of Bath' has much to recommend it, and although one cannot speak of it so confidently as of some others, owing to the comparatively short time it has been cultivated here, yet its behaviour, for several seasons, has given much satisfaction, and it will keep when gathered for a longer time in good condition than any other early variety I am acquainted with. 'Lady Sudeley,' 'Devonshire Quarrenden,' and 'Worcester Pearmain' are all well-known varieties that succeed in almost any position, or in any form of tree. These continue the supply until the middle of October, when the best of dessert fruits, for northern parts at least—'James Grieve'—is ready for use. This variety was sent here for trial many years ago, and has proved in every respect worthy of the high eulogiums that have since been bestowed upon it by growers in various parts of the country. 'King of the Pippins,' 'Ribston Pippin,' and 'Cox's Orange,' thrive well as bushes or pyramids. Some very old trees of 'Ribston Pippin' are growing against a west wall at Galloway House, and are, for this variety, in a fairly healthy state and seldom miss a crop, while in seasons like the present (1901) the fruit, for colour, size, and richness of flavour, could hardly have been surpassed in its most palmy days. A fallacy is current that young trees of 'Ribston' will not succeed for long, owing to its susceptibility to canker, but, though admitting that it is more liable to it than many others are, yet I have found no difficulty in keeping up a sufficient number of healthy trees for the requirements of a private garden. It does well when grafted upon the shy bearing 'Northern Spy,' and on a large tree in good bearing order here no trace of canker can be discovered. 'Cox's Orange Pippin' is often considered tender; but, given a favourable position and a well-drained soil, it crops very regularly in bush form, and the fruit, though later, is in the end quite as fine and richly coloured as others produced against walls.

For later use 'Scarlet Nonpareil,' 'Braddick's Nonpareil,' 'Fearn's Pippin,' 'Cockle Pippin,' and 'Adams' Pearmain' are most in favour.

Cooking Apples.—Of these, 'Lord Suffield,' 'Lord Grosvenor,' 'Duchess of Oldenburg,' 'Keswick Codlin,' 'Ecklinville,' 'Potts' Seedling,' 'The Queen,' 'Stirling Castle,' 'Warner's King,' 'Loddington,' 'Tower of Glamis,' 'Lord Derby,' 'Mère de Ménage,' 'Lady Henniker,' 'Bramley's Seedling,' 'Lane's Prince Albert,' 'Wellington,' 'Alfriston,' and 'Galloway Pippin' are all reliable as free bearers, having large fruits, and of excellent quality. These are mostly well-known varieties, and as such need no description; but, if asked to select one from the number that possessed pre-eminent merit, my choice would be 'Galloway Pippin.' It is of local origin, but is now widely distributed, and if it crops as freely and is of as good quality elsewhere as in this part of the world, it is worthy of greatly extended cultivation. Formerly the main supply of Apples hereabouts was probably of this variety, to which surmise the many old trees (some still in good bearing order, but many past their best) that may be met with in gardens of all descriptions give ample testimony.

So far, only well-tried varieties have been referred to, as it would make this paper too lengthy to mention others of recent introduction, which, although they can scarcely be expected to surpass the older ones for quality, yet, owing to beauty of form, size, and colour which some of them possess, will render them indispensable in every representative collection, and more especially where Apples are required for exhibition.

Pears.—Except in warm seasons like the present (1901), the Pear crop from the open ground, whether the trees be grown as bushes, standards, or espaliers, is not usually so satisfactory as that of Apples. The best for planting in the open are 'Jargonelle,' 'Williams' Bon Chrétien,' 'Fertility,' 'Louise Bonne of Jersey,' and 'Beurré Capiaumont,' among the finer sorts; while for very exposed situations 'Early Crawford,' 'Hessle,' 'Muirfowl Egg,' and some of the Bergamots are still favoured, and the owner of healthy, well-laden trees of these may at times realise a very handsome return for the crop. In addition to the five first-named varieties, the following do well and produce very fine fruit when trained against walls :—'Pitmaston Duchess,' 'Beurré d'Amanlis,' 'Beurré Diel,' 'Beurré Superfin,' 'Doyenné du Comice,' 'Winter Nelis,' 'Beurré Sterckmans,' 'Ne Plus Meuris,' 'Easter Beurré,' and 'Beurré Rance.' The last is not very reliable as a dessert Pear, but is excellent for stewing and, together with 'Catillac,' 'Verulam,' and 'Vicar of Winkfield,' maintains a supply throughout the season. I have unintentionally omitted 'Marie Louise,' which is the best autumn Pear grown here, and for flavour far surpasses 'Thompson's,' and 'Doyenné du Comice,' and it generally bears as freely as any variety; a fact which was apparently fully recognised in former times, as there are four old fan-trained trees, which in the aggregate cover a wall-space of thirty yards by four yards, and which, at the least, have been in existence for fifty years.

So far no mention has been made of more recently introduced Pears, as 'Triomphe de Vienne,' 'Margaret Marillat,' 'Magnate,' 'Beurré Mortillet,' 'Beurré Bachelier,' 'Beurré Dumont,' 'Marie Benoist,' and some others which have already become indispensable to exhibitors, and

which, owing to their superior size and appearance, are destined to replace some of the older ones as they get better known.

All of these are grown here against walls, where they succeed well, and, being grafted upon the Quince stock, they bear fruit in about two years from the time of planting.

Plums.—Six standard varieties for dessert are the old 'Green Gage,' 'Lawson's Golden Gage,' 'Kirke's,' 'Jefferson,' 'Denniston's Superb,' and 'Coe's Golden Drop.' 'Oullin's Golden Gage' does well in dry seasons; the same may be said of the 'Transparent Gages'; but all are too subject to splitting at the time of ripening to be relied upon for a supply of first-class fruit.

The earliest cooking Plum is 'Rivers' Prolific,' which is closely followed by the 'Czar,' both of which succeed well in the open as bush trees or against an east wall. 'Belgian Purple,' 'Victoria,' 'Belle de Septembre,' 'Pond's Seedling,' 'Magnum Bonum,' and 'Monarch' are sufficient to carry on the supply until the end of October. As a standard 'Victoria' is unsurpassed, and, if accompanied by 'Belle de Septembre' which is a trifle later in ripening, a plentiful supply of fruit suitable for cooking or preserving may be secured on any fairly good soil. 'Prince Englebert,' 'Grand Duke,' and 'Monarch' ripen very satisfactorily against walls, but in average seasons they are too late to reach maturity in the open garden.

Damsons, more than any other fruits, vary in productiveness in different parts, and appear to crop better and more regularly in high and cold positions, while in the more low-lying parts or near the seashore a full crop once in five years is about the average. The 'Crittenden' and 'Shropshire' or 'Prune-shaped' are mostly grown, the latter being the favourite.

Cherries are seldom planted as orchard trees; the difficulty of protecting the fruit from the birds renders this form of cultivation very uncertain. Against walls the finer sorts, as 'Knight's Early Black,' 'May Duke,' 'Elton,' 'Black Eagle,' 'Governor Wood,' and the 'Morello,' all succeed well.

Apricots are regarded as the most unsatisfactory of any of the stone fruits, and in many gardens their cultivation, after many disappointments, has been discontinued. The cause of this non-success is frequently attributed to the absence of sufficient lime in the soil; but it is probably due to some extent to atmospheric conditions, which induce a too vigorous wood growth late in the season, which, failing to ripen properly, results in a paucity of perfect bloom-buds, and favours the most common trouble with Apricots—the dying-off of branches. 'Large Early,' 'Royal,' and 'Moorpark' are the most reliable varieties.

Peaches and Nectarines.—It is only within well-enclosed gardens that the culture of Peaches and Nectarines is attempted; but, given this and close attention to the thinning and training of the young wood, so as to ensure its proper ripening, crops that amply repay the cost and time spent upon the trees can be secured. Only early or mid-season varieties should be planted, as late ones seldom get the opportunity to ripen sufficiently for dessert. 'Hale's Early,' 'Early Grosse Mignonne,' 'Dymond,' 'Stirling Castle,' 'Crawford's Early,' and 'Early Silver' all

succeed well in average seasons. The best of these, in my own experience, is 'Early Grosse Mignonne,' which seldom fails to yield a full crop, which, when finished, have size, colour, and flavour scarcely inferior to the best produce from under glass. Nectarines are scarcely so easily grown as Peaches, but 'Rivers' Orange' and 'Lord Napier' generally give satisfaction. Other reliable varieties are 'Elruge,' 'Violette Hâtive,' and 'Newton.'

Figs are more generally cultivated than Peaches and Nectarines, and there are but few gardens possessing a wall or the end of a building but can show one or more Fig trees. Some of these in the immediate neighbourhood of Galloway House are of great age, and fruit very freely. It however depends very much upon the weather conditions of early autumn as to whether they will ripen, but as a rule they do so. The largest-fruited and earliest is 'Castle Kennedy,' which seldom fails to ripen thoroughly; it is, however, the shiest to fruit, and until the trees attain considerable age they are not satisfactory in this respect. 'Brown Turkey' and 'Brunswick' form a good succession to the last named. In places near the coast protection in winter is unnecessary for Figs, but further inland some kind of material is used on the approach of severe weather to ward off the possible ill-effects.

Small and Bush Fruits.—Under this heading are included some of the most popular and certainly the most easily grown of hardy fruits. The moist equable climate being favourable to the full development of both plants and crops, and insect pests appearing to be less troublesome than in many parts, the culture of some or other of these is carried out in most gardens.

Strawberries.—The small early varieties, as 'Black Prince,' 'John Ruskin,' 'King of the Earlies,' and a few others, which held the premier position for so long, have now been replaced to a great extent by 'Royal Sovereign,' which possesses many good points, but we find the fruit is very apt to rot rather than ripen during spells of very wet weather. 'La Grosse Sucrée,' 'Vicomtesse Héricart de Thury,' 'Dumbarton Castle,' 'President,' and 'Elton Pine' may be named as the best standard varieties; although many of the later introductions have given every satisfaction as croppers and for quality.

Gooseberries.—All varieties that I am acquainted with flourish here, and where such is the case it is difficult to particularise; but from among others 'Early Sulphur,' 'Hedgehog,' 'Berry's Early Kent,' 'Whitesmith,' 'Rough Red,' 'Crown Bob,' 'Whinham's Industry,' and 'Warrington' can be confidently recommended for cropping and quality, either for dessert or cooking, and they maintain the supply of this excellent fruit over a long season.

Currants are also a very profitable crop, Black Currants being especially prized for preserving. These seldom fail to bear freely, but of late years the Black Currant mite has wrought much mischief in many previously healthy plantations. Many of these have been formed from very original stocks, and it would be difficult to name them; but among those of more recent date 'Baldwin's Champion' and 'Lee's Prolific' are valued for the increased size of berry, but for weight of crop it is scarcely possible to name any that are an improvement upon the older varieties.

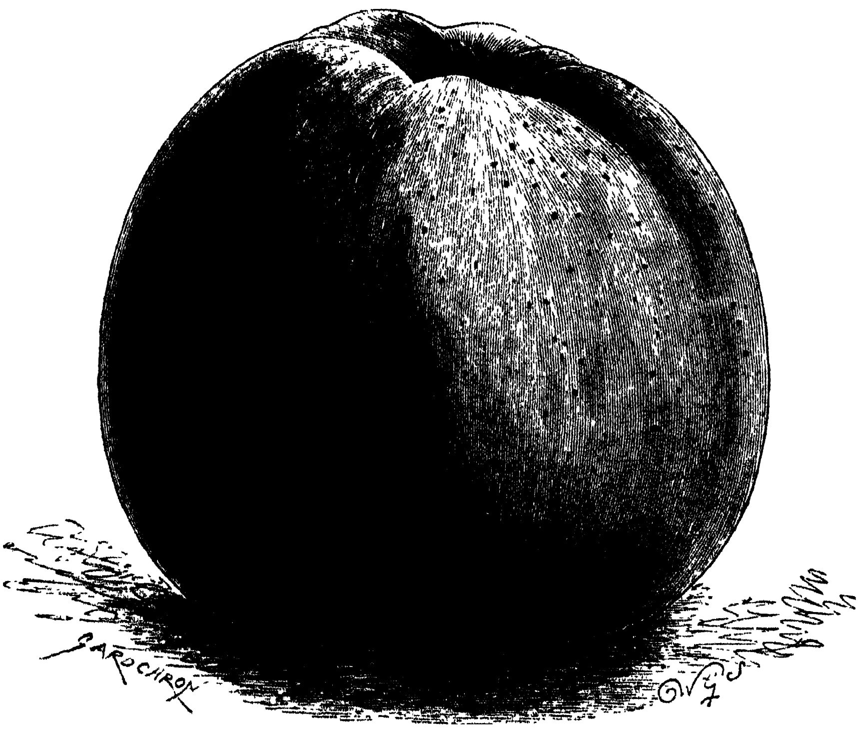
'Red Dutch,' 'Raby Castle,' and 'Victoria' have taken the place of older small-fruiting Red Currants; while 'White Dutch' and 'Transparent' are most in favour among the white varieties.

Raspberries, as may be expected in a moist climate, fruit very regularly, and such as 'White Antwerp,' 'Baumforth's Seedling,' and 'Carter's Prolific' have given satisfaction. At present the newer 'Superlative' is much sought after, and, judging by its free growth and the strength of its matured canes, it will speedily become the most popular variety.

Filberts and *Cobnuts* are not extensively grown, as only in a very warm season do they arrive at proper maturity.

Quinces, *Medlars*, and *Mulberries* are seldom met with, and as fruits do not hold an important position in northern horticulture.

The *Logan Berry* is much prized for a preserve, and where wall-space or any erection can be provided for training its long trailing growths it is at once both ornamental and fruitful.



ON STRUCTURAL ADAPTATIONS TO EXTERNAL MECHANICAL FORCES; AND THE DISPLAY OF THESE BY PLANTS THEMSELVES.

[Lecture delivered October 29, 1901.]

By Rev. Prof. G. HENSLOW, M.A., F.L.S., V.M.H., &c.

INTRODUCTION.—Professor Huxley, in speaking of Lamarckism, said somewhere (I write from memory) that if it were true for the animal kingdom it could not apply to the other half of the living world. This is, however, precisely what it does.

The object of the present paper is to show that plants are quite as sensitive to external mechanical forces as animals; that they not only constantly display such themselves, but that they must overcome the external pressures, strains and pulls, &c., to which they are subjected, or they will suffer from them.

Their capacity for doing this resides in a responsive power possessed by protoplasm, which enables plants and animals alike to build up tissues so as to resist possibly injurious effects from without.

The exhibition of mechanical forces is seen in all parts of plants, and at all periods of their life-history, from germination to the ripening and dispersal of fruits and seeds.

As I shall only be concerned with flowering plants, I must pass over the innumerable instances of mechanical movements in microscopic organisms, such as zoospores, &c., and confine myself to a few illustrations taken from the various organs of plants, such as roots, stems, leaves, flowers, and fruits.

Germination.—I would refer the reader to Darwin's "Movements of Plants" for a full account of the phenomena of motion exhibited by the radicles and shoots (hypocotyls and epicotyls) of germinating plants. The mechanical forces therein displayed are of the utmost importance. Thus, "circumnutation," or "bowing around," as the term implies, of the radicle, enables it to find a point of least resistance where it can penetrate the soil. The energy of growth enables it to thrust its way in with great force. Darwin roughly measured this energy and found that the tip of the radicle of a bean could exert a force of upwards of a quarter of a pound in twenty-four hours. In another case it was 8 lb. 8 oz.; but it was, as he says, probably much greater than that. Moreover, even soft fungi have been known to raise, not only the hardened asphalt on a path, but even the pavement of a street in Basingstoke, and a cemented hearthstone of a kitchen.

Similarly the upward growth of the stem of a seedling underground, aided by circumnutation, readily upheaves a considerable weight of earth, and overcomes the resistance of the great pressure of the soil upon it.

When the stem has reached the surface and begins to grow erect in the air, it is perfectly obvious that it is constantly subjected to mechanical strains, especially of gravity or the attraction of the earth, which is always

pulling it in the direction of the earth's centre ; as well as of wind, which tends to bend it horizontally.

Stems must be strong enough to resist these strains, or they will fall to the ground and possibly break in two.

Botanists have invented the terms "positive geotropism" for the result of the action of gravity ("geotropism" only meaning "turning earthwards"), and "apogeotropism" or "negative geotropism" for the growth of the stem in the opposite direction, or upwards. They express facts, but in no way explain how they come about. Gravity has no power to do anything but attract all matter, alive, dead, or inorganic, in a direction perpendicular to the surface of the earth, according to well-known laws. Consequently, when a stem grows erect we must look for some *cause* which induces it to grow *in opposition* to the force of gravity. This was primarily light.* Stems were primarily incited (*i.e.* in their evolutionary history) to grow in the direction of the greatest illumination, viz. the sky ; but in so doing they were obliged to grow in opposition to gravity. This has now become a hereditary feature independent of light. For stems will now grow vertically in total darkness, and if the end of a shoot which has been "drawn" to one side by a lateral source of light be covered over, it will then proceed to grow vertically upwards.

In so doing the stem must support its own weight. As long as plants are quite young "the rigidity of succulent shoots, especially in length, depends essentially upon the [elastic and turgid] conditions of the layers of tissue." † They soon, however, develop wood and other tissues of support.

Roots.—As soon as the radicles have developed roots their force of growth becomes enormous, increasing of course with age. Thus Sir J. D. Hooker writes in his "Primer of Botany" ‡ :—" With such force does growth go on that stones of walls are frequently displaced by roots. In tropical countries the destruction of buildings is often caused by the power of growing roots; and neither conquering nations, nor earthquakes, nor fires, nor tempests, nor rain, nor all put together have destroyed so many works of man as have the roots of plants, which have all insidiously begun their work as slender fibres."

Trees may often be seen with a considerable portion of their roots out of the soil. This has resulted from their growth against the resistance of the soil, acting as a fulcrum, so that they have elevated the trunk of the tree, which now appears supported, as it were, on slanting props diving into the ground.

Stems.—Soon after germination, the stem develops special "supportive or mechanical tissues," such as wood-fibre, bast-fibre, sclerenchyma, collenchyma, &c.§

* For further explanation and illustration the reader is referred to *The Origin of Plant Structures*, p. 197, ff.

† Sachs, *Physiology of Plants*, p. 217. ‡ P. 38.

§ *Wood-fibre* consists of thickened spindle-shaped cells which, compacted together, make wood. *Bast* or *liber-fibre* consists of very long thickened cylindrical cells tapering at the ends, much thickened, but remaining elastic. *Sclerenchyma* in stems (flower-stalks, &c.) consists of elongated cells thickened with very hard matter. The "grit" of pears and the tissue of "stones" of fruits are cells similarly hardened. *Collenchyma* is a thickening of the angles and sides of a softer substance, giving a more coriaceous or leathery texture to the organ.

Gravity acts as a *stimulus*, under which the plant develops these supportive tissues, in order to resist the pull earthwards, which is always at work.

There is ample evidence to prove that the protoplasm of plants resembles that of animals in responding to the influence of external forces, and strives to acquire and to sustain an equilibrium with them. The above-named tissues are the result of this "effort," though they, of course, cannot do this suddenly, like a man using his muscles to prevent himself from falling if he have lost his balance ; but the result is no less effective, though it be executed by the slow method of growth ; just, indeed, as an athlete's muscles will gradually enlarge under repeated exercise.

On the contrary, in submerged water-plants, this effort is not required ; and consequently the supportive tissues almost entirely fail to be formed ; for such plants (with the aid of air in their lacunæ) are of much the same specific gravity as water, and therefore miss the external stimulus of any strain to which they can respond.

Water-plants, therefore, are always more or less degraded in structure, just as muscles become reduced in size or atrophied if not employed.

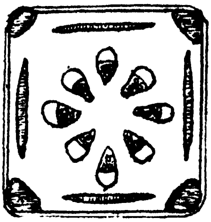


FIG. 274.—Trans. sect. of stem of Dead-nettle, showing the distribution of collenchyma-strands at the corners and sides, together with 8 fibro-vascular bundles within them. (After Kerner and Oliver.)

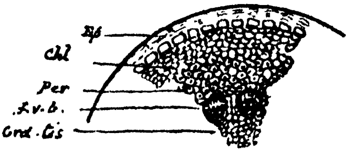


FIG. 275.—Trans. sect. of flower-stalk of *Ixia*. *Ep.*, epidermis; *Chl.*, cells with chlorophyll; *Per.*, pericycular sheath of elongated sclerenchyma; *F. v. b.*, fibro-vascular bundles; *Grd. tis.*, ground tissue.

Similarly, with large and massive cellular plants, as of a *Cactus*, little or no strengthening material is required, such as woody tissue, consequently the fibro-vascular bundles are, in certain ways, of a degraded character. When, however, even such stems are artificially subjected to strains, they at once begin to develop wood ; as Mr. Herbert Spencer found to be the case in the experiments carried out by Mr. Croucher of Kew :—"In such types as *Cereus* and *Opuntia* we see as in the [fleshy] Euphorbias, that where little stress falls on the vessels, little deposit [of wood] takes place around them ; while there is a deposit where there is much stress."*

Analogous results take place under degeneration brought about by other causes than water. Thus M. Costantin's experiments proved that when normally aërial stems are grown underground the supportive tissues become at once arrested, and the new portions begin to approach in structure to rhizomes, which are normally subterranean and develop little wood. "Use" and "Disease" are, therefore, quite as applicable to plants as to animals ; for while the muscles in the arm of a blacksmith

* *On Circulation and the Formation of Wood in Plants*, Trans. Linn. Soc. 1866, p. 405.

or of an athlete increase with effort and decrease with disuse, so do plants develop tissues under the influence of strains, &c., which best enable them to meet the various forces to which they may be subjected. On the other hand, such tissues are more or less arrested when no strains are present.

It is in accordance with this property of plants that we find projecting angles and columnar structures generally composed of collenchyma on the surface of erect herbaceous stems, as in the *Labiatæ* and *Umbelliferæ*: pericycular sclerenchyma in the flower-stalks of Carnations, Ixias, &c., and huge buttresses to some foreign tropical trees. (Figs. 274, 275.)

The general conclusion arrived at from the study of the forms and distributions of supportive tissues is that they are perfectly analogous to what takes place in animals. Prof. Haughton has shown, in his lectures

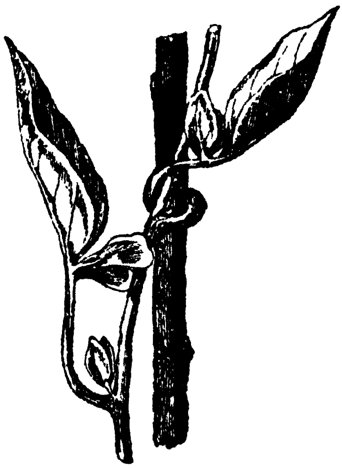


FIG. 276.—*Solanum jasminoides*, with one petiole twined round a support and thickened. (After Darwin.)

on "The Principle of Least Action," how the muscular arrangements and structure and the forms of their supporting bones in animals all follow this law; that is to say, whatever force is required, the machinery has been evolved to meet the case. I would venture, therefore, to lay it down as universal in the living world, that the necessary structures in both kingdoms have been evolved as Lamarck supposed them to have been effected, through use and in response to effort.

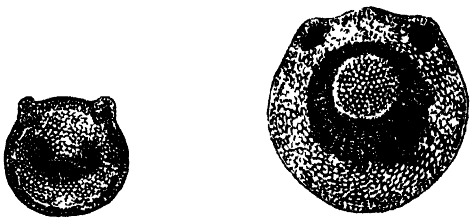
Experimental and Natural Proofs of Adaptation.—As an illustration derived from experiments with plants, M. R. Hegler showed that an increase of strength and development of the mechanical tissues of plants resulted from the application of artificial strains produced by weighted strings. Thus, the hypocotyl of a seedling Sunflower, which would have been ruptured by a weight of 160 grms., bore a weight of 250 grms. after having been subjected for two days to a strain of a weight of

150 grms. The weight was subsequently increased to 400 grms., without injury.*

One of the best illustrations is seen in climbing plants,† of which Darwin gave a good instance, with figures of the altered petiole of *Solanum jasminoides*, the leaf-stalk of which has normally a small horse-shoe-shaped mass of wood below, and two isolated cords above—that is, as seen in a cross-section. But, after having caught permanently hold of some object, the "horse-shoe" becomes a complete "circle," *i.e.* of course, a cylinder of wood running up the petiole, just as in a stem.‡ (Figs. 276, 277.)

If a section of an Ivy stem be taken from a plant growing against a wall, and another of the same diameter be cut from the part of the Ivy growing freely in the air, it will be found that the amount of wood in the latter is appreciably greater and the pith less than in the former, since it is self-supporting and not aided by the adhering roots.

Another interesting case is that of *Wistaria*. This is usually grown as a climber, but some florists have cultivated it as a standard. When



A B

Fig. 277.—A, Trans. sect. of petiole of *Solanum jasminoides* before; and B, after attachment to a support. (After Darwin)

this is the case it does not make long annual shoots as its energy is expended in increasing the thickness of the trunk, which has to support the head of boughs and flowers.

When, however, it is grown on a trellis, it will then make annual shoots, sometimes of 30 feet in length in the United States. A similar difference will also be found, as mentioned in the Ivy, in the thickness of the wood, between a supported and a self-supporting shoot.

Effects of Adaptation.—I have already observed, generally, that stems grow upwards under the influence of light, and in so doing necessarily subject themselves to the effect of gravity, which is always trying to pull them down, so that they must be able to resist the strain. This they do by making wood. If a tree be much exposed to wind on a hilly place it will be observed that it becomes short-stemmed, and more or less rounded above, while the same kind of tree will grow tall and branch freely in a sheltering valley. Moreover, if the prevailing wind be, say, from the south-west, the section of the stem will be more oval than circular, the long diameter being also in the same direction as the wind. Again, large

* For further illustrations the reader is referred to *The Origin of Plant Structures*, ch. x. p. 197.

† *Op. cit.* p. 72. ‡ *Climbing Plants*, p. 72.

horizontal branches have often eccentric rings of wood, as seen in a cross-section. This is due to the fact that the weight of the bough continually increases, consequently the leverage is gradually increased, so the weight must be overcome by strengthening the bough, on the underside especially, and at its insertion into the trunk of the tree. Such a bough may often be found to have the centre of the annual rings considerably above the actual middle of the bough.

When a horizontal bough is over-weighted, as by snow, or has decayed, the equilibrium is destroyed and it breaks off, not at the actual base of the bough, where it issues from the trunk, but at a short distance from it. The accompanying diagrams will explain why it is so. Fig. 278 represents the distribution of forces when a man lifts a ladder. He puts his foot against the lowest rung as a fulcrum (F), and holds one higher up (P, the "Power"). He thus overcomes the resultant of F and W (the Weight of the ladder). As long as he stands with the ladder in his hands without pulling it up, the three forces are in equilibrium. So is it with a bough of

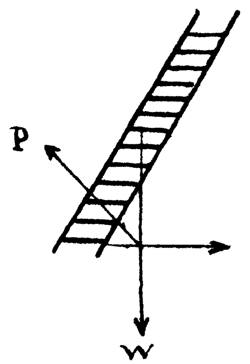


FIG. 278.—Diagram showing the distribution of forces in raising a ladder.

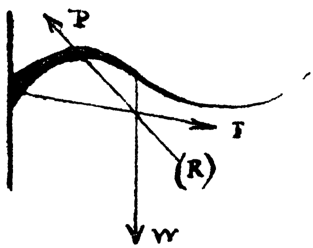


FIG. 279.—Diagram showing distribution of forces keeping a bough in equilibrium.

a tree as growing horizontally out of a tree-trunk. Fig. 279 represents the usual curvature of such a bough. The arrows represent the three forces normally in equilibrium. W is the weight of the bough, F the force acting through the fulcrum at the base of the bough, P is the power to resist the resultant of the other two (R). Now, if W becomes too great, F remaining the same, this resultant (R) is greater than P, and the bough snaps off at the place where this "pulling force" is acting, and consequently it leaves a "snag" projecting from the trunk.

It will be observed that "declinate" stamens, which support the insect visiting a flower, are precisely of the same curvature, this being the best form for supporting a weight at a distance from the fulcrum.

Stem-girders.—Mechanical appliances invented by engineers are often close imitations—though they may not have intentionally copied them—of similar ones in Nature. Thus it has been noticed that the distribution of the woody bundles in herbaceous stems is on the same principle as is followed in the construction of iron girders. Thus Dr. Kerner observes, speaking of the woody bundles in a stem:—"If they were confined to the centre it would be anything but a suitable arrangement for an erect

stem, as they would contribute almost nothing to the resistance to flexion." For if a bough be bent sufficiently it will begin to break at the circumference on the convex side, but be contracted on the concave side; while but little strain will be felt in the middle of the stem. Consequently, Nature places the woody bundles in a circle *near the circumference*, the centre being occupied by soft tissue. This arrangement supplies a combination of girders representing the "beam" or "web," which usually

FIG. 280.—Trans. sect. of a branch (one year old) of Lime tree, with six fibro-vascular bundles. (After Kerner and Oliver.)

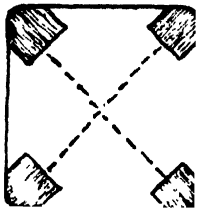


FIG. 281.—Two combined "girders," arranged crosswise; the dotted lines indicate the "web," the shaded parts the "flanges." (After Kerner and Oliver.)

consists of a flat piece of iron having "flanges" or cross-pieces at its ends. They form as it were two T's united by their bases (or rather the letter I).

Each fibro-vascular cord constitutes a flange, and the combined webs are formed of cellular tissue, constituting the pith. (Fig. 280.) The accompanying illustrations, taken from Kerner and Oliver's "Natural History of Plants," will show some combinations of girders and how hey imitate the structure of stems.

Fig. 281 represents two combined girders arranged crosswise; the dotted lines represent their webs. This may be compared with the strengthening collenchymatous tissue in the four corners of the stem of the Dead-

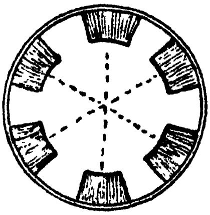


FIG. 282.—Three combined girders. (After Kerner and Oliver.)

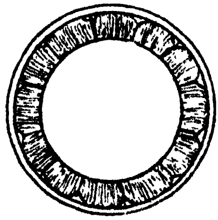


FIG. 283.—Six combined girders, now forming a cylindrical tube by mutual pressure and union. (After Kerner and Oliver.)

nettle (fig. 274). Fig. 282 shows three combined girders, a common appearance in many pedicels of the flowers of Monocotyledons.

In fig. 283 we arrive at a complete cylinder formed of six combined girders, their flanges being laterally in contact and coherent. Great strength is thus gained by their mutual pressure, so that no web is needed and the cylinder may be hollow. Of course this is one of the commonest appearances in stems, which may or may not retain the pith. Such hollow stems almost invariably develop transverse plates at the nodes, to

add to the strength and avoid breakage by transverse strains, as may be seen in a straw and in the stem of the Dead-nettle.

Secondary girders are not uncommon in stems, and are imitated by such a structure as is illustrated in fig. 284, in which it will be seen that the flanges are themselves formed of secondary girders. This may be compared with fig. 286, in which, in addition to such secondary girders

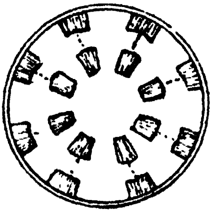


FIG. 284.—Four combined girders; their flanges are formed of secondary girders. (After Kerner and Oliver.)

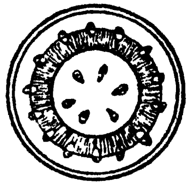


FIG. 285.—Trans. sect. of stem of Crow Garlic (*Allium vineale*). The pericycle has formed a cylinder of supportive tissue. (After Kerner and Oliver.)

arranged around a hollow centre, there is a band of strengthening tissue on the circumference.

In fig. 274, representing a section of the stem of the Dead-nettle, we see two pairs of collenchymatous girders at the corners and another pair at the sides, and, in addition, four pairs made by the fibro-vascular cords.

In monocotyledonous stems a solid cylinder is made by means of the active layer of tissue known as the "pericycle," situated just below the cortical region. Besides forming a rigid circular band in the ground-tissue, several fibro-vascular cords may be developed within it, outside the primary ones. Fig. 285 represents such a condition in the stem of *Allium vineale*.

Fig. 286 is a section of the centre of the Common Reed (*Phragmites*

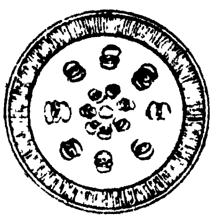


FIG. 286.—Trans. sect. of stem of Common Reed (*Phragmites communis*), Cp. Fig. 284. The fundamental tissue has formed a cylinder of supportive tissue. (After Kerner and Oliver.)

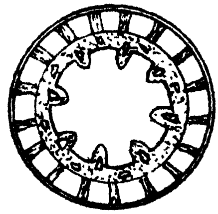


FIG. 287.—Trans. sect. of stem of Purple Molinia (*Molinia cærulea*). The pericycle has formed a cylinder of supportive tissue, connected with the circumference by radial supportive bars. (After Kerner and Oliver.)

communis), in which, besides the circumferential cylinder formed in the ground tissue, each fibro-vascular cord is a girder by itself, the vessels constituting the web, and the more solid tissue at the two ends constituting the flanges.

In fig. 287, exhibiting a section of the culm of the grass *Molinia cærulea*, besides the pericycular strengthening cylinder (represented

dotted), there are radial stiffening bands connecting this with the circumference, acting as webs to the combined girders making the inner and outer cylinders. The centre is hollow. If the inner circle be reduced in size and the radial bars elongated, it will be at once perceived that we have a construction of any ordinary wheel with spokes. There is no need for great strength in the latter, as the combined girders bear all the stress, so that they are often made extremely slender, as in the wheels of a bicycle.

Climbing Stems.—It is well known that the structure of the stems of woody climbing plants is very anomalous: *i.e.* as compared with an ordinary, erect stem of a shrub or tree. The explanation is that the abnormal distribution of wood, pith, medullary rays, and bast, as seen in woody lianas of tropical forests, is the result of a response to the strains to which such plants are inevitably subjected. Though there is great variety among them, the internal features are generally to be seen in feeble wood, much superficial and irregularly formed corky tissue, together with large and many vessels. Such a combination allows of much elasticity and resiliency. The external forms of such stems are also various. Thus, some develop long ridges, and, becoming twisted,

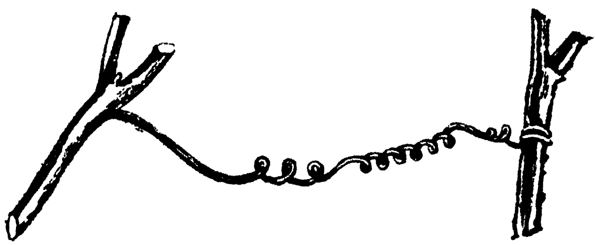


FIG. 288.—Tendril of Bryony (*Bryonia dioica*). (After Darwin.)

they closely resemble a cable in appearance, strength being acquired in both alike by the spiral twisting.

Others are flattened like broad woody ribbons, bulging in and out like waves, strengthened by flange-like ribs at the edges. Such is the case with *Caulotretus,* the Monkey Ladder, and *Bauhinia.* But whatever the form may be, it is specially adapted for strength and to sustain any strains.

In tendrils, as of Bryony and Passion-flowers, as soon as they have caught anything they coil up into spirals, but the number of the "turns" is equally distributed both ways. This enables the accumulated force of one set of coils to be neutralised by that of the other, while the whole series allows of considerable amount of play, which prevents the tendril being torn in stormy weather. Fig. 288, taken from Darwin's work on "Climbing Plants," illustrates this coiling in the tendril of the Bryony.

Mechanical Movements in Leaves.—The use of mechanical contrivances in these organs is very frequent, if not universal. Thus, in his book on "Insectivorous Plants," Darwin has shown how the longer circumferential "tentacles" of the Sun-dew will curve over any fragment of nitrogenous matter placed on the shorter ones in the middle of the blade, and how the two halves of the blade of the Venus' Fly-trap will

almost "snap" together like a rat-trap when one of the three bristles on the blade is touched. (Fig. 289.)

Again, the mechanical movements of the leaflets and petioles of Sensitive Plants are well known. They are due to a disturbance in the equilibrium in consequence of water being discharged from the cells of the thick "pulvinus" at the base of the petiole into the intercellular spaces on the *underside*, which causes the *lower* half of the tissue of the petiole to collapse, with the resulting fall of the petiole. The cells of the lower half of the cortex have their walls not so thick as those of the upper half above the "central cylinder" of wood-fibres, &c., which play no immediate part in the movement. The fall of the petiole is therefore simply due to a diminution of tension of water which kept the petiole erect, and this is caused, as stated, by loss of turgidity. Water escapes from the cells into the intercellular spaces and then out of the motor organ altogether, equilibrium is overthrown and the petiole falls.

It is a precisely similar means by which the two halves of the leaf of

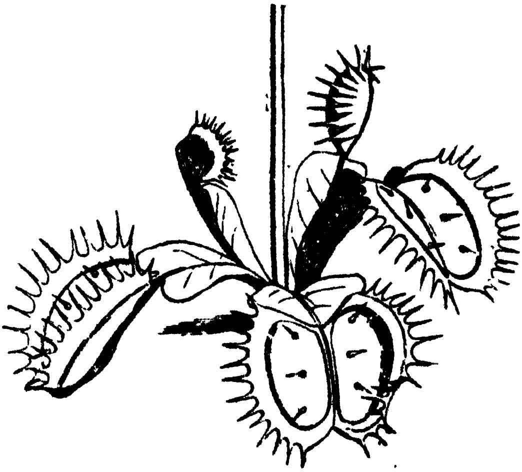


FIG. 289.—Foliage of Venus' Fly-trap (*Dionæa Muscipula*). (After Le Maout and Decaisne.)

Venus' Fly-trap (*Dionæa Muscipula*) (fig. 289) close. When the leaf is horizontal the fibro-vascular bundles spread horizontally through an upper and a lower layer of cellular tissue. It is the upper one only which is concerned with the motion. The free bristles have their bases of cellular tissue in continuation with the layer. When they are touched turgidity gives way, and the now more turgid *lower layer* forces up the upper and weaker one till it meets the opposite lobe. Hence, the movement itself is purely mechanical.

The question arises, How is the water discharged? Each cell consists of protoplasm covered by cellulose, the latter being an elastic coat which presses on the protoplasm within it; but this has the property of absorbing water to its fullest capacity, so that in the unexcited state the cells are in a condition of unstable equilibrium, for the cell-wall and its enclosed protoplasm are in a constant state of antagonism.

When the protoplasm suddenly loses its power to retain the water, the

cell-wall instantly contracts and expels it. The protoplasm—which is highly sensitive to a mechanical influence—is the active seat, but the cell-wall is the mechanical agent which does the work, by means of its elasticity and the tension to which it has been subjected.

Mechanical Structure of Leaves.—We must now consider the structure of leaves, to see how they are enabled to stand out horizontally without falling under the influence of gravity. We have seen how stems respond to strains; petioles and blades will also do so. If a weight be attached to a growing leaf-stalk, it will be subsequently found to develop more supportive or strengthening tissue than it would have done normally.

Of course the petioles must be so constructed as to sustain whatever weight the blade itself may have. In the gigantic leaves of many palms their weight must be enormous. To do this the petiole completely

FIG. 290.—Calyx of Dead-nettle.

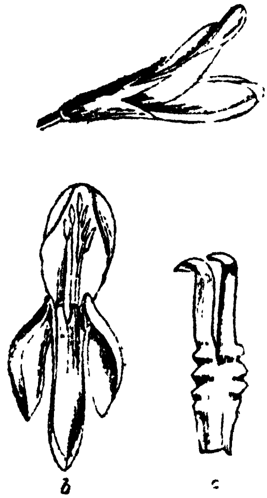


FIG. 291.—*Genista tinctoria*: *a*, flower ready for insects; *b*, after explosion, seen from the front; *c*, claws of keel petals, showing curvature and contraction, causing the fall of these petals.

sheathes the stem, the sheath being provided with layers of woody fibres crossing each other. The whole thus gives great "purchase" to the stalk.

One of the commonest methods of strengthening the petiole itself is also on the principle of a girder. It will be noticed on numerous herbaceous plants, as of the Umbellifers, that the petiole is more or less deeply grooved on the upper side; this means that the petiole has "run up" a pair of flanges. These act as a strengthening against any transverse rupture by weight.

As for the blade, it is easy to see how the "ribs" and "veins," as the framework or "skeleton" is called, are distributed so as to support the intermediate tissue and display it to incident light in the best manner possible.

Mechanical Forces displayed by Flowers.—In studying the structure

of flowers in connection with insect fertilisation, there are numerous instances to be seen of the use of mechanical forces for executing that important function.

There is, first, the actual building up of the calyx and corolla with strengthening ribs, &c., so as to be able to sustain the weight of the insects without collapsing under it. This is well seen in tubular flowers of many of the Gamopetalous division. If the corolla is a strong one, and able of itself to support the insect, as of the Foxglove, into the long tubular corolla of which a large humble-bee can crawl, there is no necessity for any additional aid from the calyx, which remains polysepalous. But if the tube of the corolla be small and slender in comparison with the limb, which may consist of a large lip in front and a hood behind, then the calyx may undertake to support the corolla-tube, so that it will not yield to the weight of a large insect. This is well seen in many of the *Labiatæ*,* as in the Dead-nettle. Thus, in Salvias, the calyx is somewhat two-lobed, as if it were "stretched," with a tendency to split at the sides. To avoid doing this, and to strengthen the calyx-tube, several

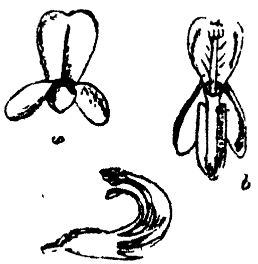


FIG. 292.—Lucerne (*Medicago sativa*): *a*, flower, seen from front, ready for insects; *b*, after explosion; *c*, corolla removed, to show the rigidly curved position of the stamens.

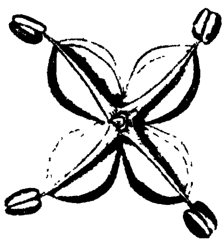


FIG. 293.—Male flower of Stinging-nettle, with expanded sepals and spread-out stamens.

additional woody cords are introduced along the lines of junction of the sepals. There are more in the anterior than in the posterior half, as the strain is greatest in front. If C in the accompanying diagram represent the normal cords or midribs of the calyx-sepals, the asterisks will stand for additional ones along their united margins; the uppermost C being on the posterior side of the flower. Corolla-tubes are often strengthened by having numerous fine cords running up them in addition to the primary five, which characterise the five petals, if it be a Dicotyledon.

C
* *
C C
* *
* *
C C
* *
*

Springs.—Besides these strengthening arrangements by means of extra cords, strong folds often occur, and these may act as movable springs and levers. In some leguminous plants very strong springs occur, as in Genistas (fig. 291) and *Medicago* (fig. 292). In the former the claws of the wing and keel petals are at first horizontal (fig. 291 *a*), but by the time the

* Both the shape of the calyx and its strong ribs will be seen to be in adaptation to the corolla in order to support it.

flower is mature they are in a great state of tension, so that when a bee alights upon them the weight of the insect disturbs the equilibrium and the petals drop vertically (*b*) by the curving of the claws (*c*).

In the case of the Medicks, it is the staminal tube (fig. 292 *c*), and not the petals, which constitutes the spring. This curves upwards, forming a semicircle or more (*c*). In both flowers, the bee will be violently dashed with pollen. In figure 292, *a* represents a flower seen from the front *before*, and *b* the same *after* the explosion.

In the Barberry, the stamens, from having been at first spread out upon the expanded petals, if lightly touched, spring forward upon the pistil.

In the male flower of Nettles, the stamens are incurved in bud; but as soon as the four sepals open out, the four stamens spring out, violently recurving themselves (fig. 293). A little plant allied to the Nettle does the same, and as the pollen is ejected into the air it has acquired the name of "Powder and Shot."

In Rock-roses (*Helianthemum*) the numerous stamens, if gently gathered up between the first two fingers and the thumb, slightly compressed, and then liberated, instantly spread themselves out gently upon the petals.

Tensions and Elasticity.—The force of tension is well exhibited in the florets of the so-called "flowers" of the large family of Composites. This name is derived from the fact that the "flowers" or "heads" of these plants are not simple, but aggregations of florets, each of which has five stamens attached to the tube of the corolla by their filaments (fig. 294).

The fine anthers are long, and instead of being free are united side by side (*a*), so that they form an elongated cylinder or tube, held erect upon the five filaments as supports (*b*), which arise from their insertions on the corolla (*c*). These are highly elastic. The tips of the anthers in the unopened stage of the floret bear triangular flaps above the anther-cells, which close over the end of the tube. The style of the pistil passes up the middle of this anther-cylinder, so that its extremity abuts against the closed end of it. The stigmas, when fully developed, consist of two flat branches called "style-arms" (see figure), having the "stigmatic" surfaces on the inner side, being pressed together as long as they are within the tube.

At the period of expansion of the corolla, the style is continually elongating, and, by pressing upwards against the closed summit of the anther-tube, *stretches the elastic filaments to their fullest extent*, so that as soon as the anther-tips give way the filaments, by their contraction, *drag the anther-cylinder downwards*, while the style protrudes out of the top, elevating the stigmas into the air. In so doing the pollen is swept out of the cells and brought up to the air. The grains of pollen thus ultimately appear aggregated on or about the summit of the elevated style.

It is not until the style is well through the anther-tube that the two branches of the stigma diverge, looking like a pair of ram's horns, and exposing their stigmatic surfaces, which are thus ready to receive the pollen conveyed by insects from some other flower.

A central or disc-floret of the Cornflower (fig. 294) illustrates these features remarkably well. Besides the elasticity of the filaments, they are very excitable just when the pollen is about to be shed. If a filament be only touched it contracts, and then the excitation spreads to the others, so that the anther-tube is depressed. It has been observed that this shortening of the filament closely resembles the contraction of muscle, though the latter will shorten by a third of its length, but a filament only by one-sixth. This shortening is also effected by a discharge of water from the cells into the intercellular spaces, just as has been explained above in the case of the leaves of Venus' Fly-trap and the Sensitive Plant.

In the case of *Stylidium*, in which the filament and style are united,

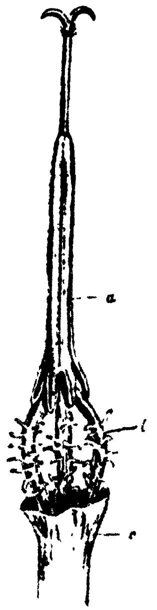


FIG. 294.—Stamens and style of a floret of Cornflower, showing contractile filaments (*b*), below the anther-tube (*a*), arising from the corolla-tube (*c*). (After Burdon Sanderson.)

FIG. 295.—Flower of *Stylidium*, showing the column (filaments and style united) bent down before irritation. (After Burdon Sanderson.)

the column at first bends downwards; but if touched it springs over to the opposite side of the flower (fig. 295).

These are but a few examples of quick-moving spring-like structures in flowers. In all cases the use of such displays of mechanical force is to secure pollination by insect visitors.

The Orchid family supply several very interesting cases; in some it is the labellum which moves, in others, as *Catasetum*, it is the pollen-mass and its appendages which constitute a powerful spring; but as these have been described very elaborately by Darwin in his work "The Fertilisation of Orchids," I need only refer the reader to it.

The stigmas of flowers are sometimes movable. Thus, in the Musk plant and other species of *Mimulus*, the two stigmas are like flaps

spread out one above the other and facing the front or lip. If a slight touch be given along the line of junction they immediately close up.

A similar movable stigma occurs both in *Salpiglossis* and even in an allied family, *Bignoniaceæ*, for it occurs in *Tecoma* and *Catalpa*.

In all cases of movements of floral organs the immediate cause appears to be the same as in *Dionæa* and *Mimosa*, in that it is by a loss of turgidity on one side of the organ, so that it contracts; and the other side, not having done so, of course makes the organ move in the direction of the contracted side.

If it be further asked, why does the protoplasm lose its water on being touched, or, rather, on "feeling" the touch, so to say, through the cell-wall, it is impossible to reply, because we do not know what life is. A similar question might be asked, Why does the foot draw itself away, if the sole be irritated, in spite of all volition at our disposal to prevent it?

Levers.—The following descriptions will illustrate some cases of these mechanical powers. The *first kind* is that in which the *fulcrum* is

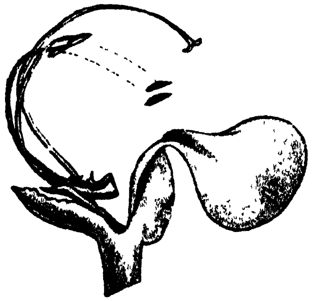


FIG. 296.—Anterior portion and stamens of *Salvia*, showing arrangement of stamens and their action.

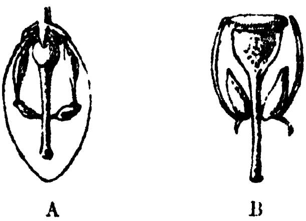


FIG. 297.—Vert. sect. (A) of unopened, pendulous flower of Strawberry tree (*Arbutus Unedo*), showing young anthers adhering by their tips to the style; (B) stamens and style of fully expanded flower, showing anthers now inverted.

between the *power* and the *weight* or resistance, as in resting a poker on the bars (the fulcrum) to raise the coals (the weight) in a fire. An instance of this kind will be found in the genus *Salvia* (fig. 296). The flower has two stamens adherent to the corolla by very short filaments, each of which carries two anthers, *separated by a long curved "connective."* These stand in a vertical plane, the upper anther-cell produces pollen, but the lower one has usually none, and forms a spoon-shaped end. The connective forms an arc of a circle, but is attached to the filament at a point (upon which it oscillates) much nearer the lower end than the upper one (see figure). The result is that it forms a lever of which, on depressing the short "arm" below, the long arm swings through a considerable distance; and if it be supposed that a bee, on alighting on the lip in front and striking the empty anther-cells below, has depressed it in searching for honey, the upper anther-cells come down into the position shown in the figure, and deposit their pollen on the bee's back. The forked stigma projects forward in a suitable position

for striking the bee just where the pollen has been deposited from a previously visited flower.

A lever of the second kind is not uncommon among plants; a familiar illustration is seen in a sugar chopper, in which the knife is hinged at one end, the handle being free to move up and down at the other; while the block of sugar is between the *fulcrum* at the hinge and the *power* in the hand, and constitutes the *weight*, i.e. in this case, the resistance to the chopper. A pair of nutcrackers is a double lever of the same kind; the nut gives the resistance to be overcome between the common "fulcrum" at the hinge and the *two* "powers" in the hand.

A remarkable illustration of this kind of lever occurs in the development of the stamens of the flower of the Strawberry tree (*Arbutus Unedo*). In the bud the anther possesses a pointed tip, which is in contact with the style and fixed to it by a gummy secretion (fig. 297 A). The anther is capable of moving by a sort of joint at its base where it is attached to the filament. Consequently, as the latter elongates, the lower ends of the anther-cells become tilted up, as if to rotate round the fixed point. This motion continues until the anther is quite inverted (B). Then the cells dehisce at the highest point, this being really the true base of the cells.

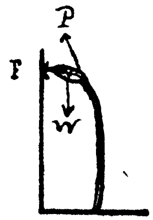


FIG. 298.—Diagram to illustrate the distribution of forces in the growing stamens of Strawberry tree.

In this process (illustrated by figure 298) the *fulcrum* (F) is the point of adherence at the apex. The *weight* is the resisting body of the anther (W); while the *power* (P) is the vegetative force of growth trying to elevate the anther, which it simply overturns by rotating it round the pivot as a fulcrum.

Lever of the third kind. In this the power is between the fulcrum and the weight. Thus, in holding out a heavy weight at arm's length, the fulcrum is the elbow-joint, the power resides in the muscles of the fore-arm.

Now, a large number of flowers have no front petal upon which an insect can alight. In such cases the stamens, and sometimes the style as well, first curve downwards and then again upwards, as already described in speaking of the leverage of a horizontal bough of a tree. The point of attachment of the filaments to the corolla or floral receptacle is the fulcrum; the weight of the insect is at the further end, or near it; and the power exerted by the filaments is situated at the curve near the base of attachment; so that the filaments are like a horizontal reversed ∽. The arrangement will be understood from figure 279.

The Lever and a Hollow Screw.—In the Scarlet Runner there is a combination of a lever with what somewhat resembles an Archimedean screw used for elevating water. In this flower the keel petals, instead of

being straight, have a right-angular bend, and their extremities twisted spirally. The pistil, which is included within them, has its style coiled in a corresponding manner. Just below the stigma is a tuft of hair upon the style. On looking at an expanded flower from the front it will be noticed that the wing petal on the left is smaller than the one on the right, and that the orifice of the spirally twisted end of the keel petals projects over the left or smaller of the two wing petals.

An insect, *e.g.* the hive bee, always alights upon the smaller wing petal. The wings have peculiar depressions upon their inner surface, which catch hold of corresponding elevations on the exterior surface of

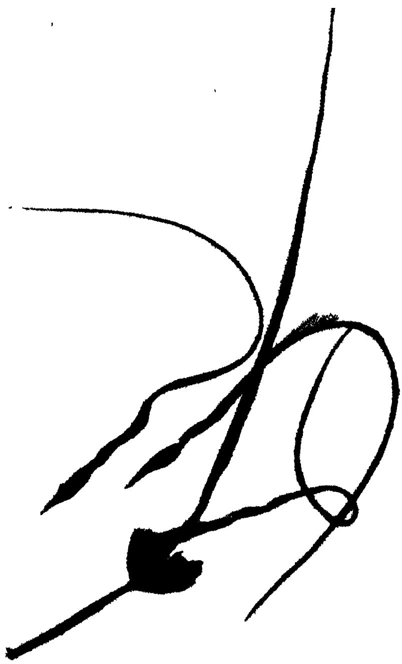


FIG. 299.—Fruit of Stork's-bill (*Erodium*), showing spirally twisted awn-like beak. (Phot. *ad nat.*)

the keel. The result is that, by acting as the *power* of the lever, the weight of the insect depresses the smaller petal; the force is communicated by the grip-like action of this petal to the spiral keel, which, by being dragged downwards, causes the spirally twisted style to pass up the hollow coil, so that the stigma now protrudes out of the orifice of the "snail-shell" shaped extremity of the keel. The tuft of hair on the style sweeps the pollen from the cluster of anther-cells in its passage outwards, through the middle of which it passes, and deposits it upon the back of the bee which is there ready to receive it.* It is thus roughly

* The reader is recommended to take the first opportunity of examining a flower of the Scarlet Runner; and if he will raise and depress the *left*-hand wing, holding it between the forefinger and thumb, he can imitate the action of a bee, so that the stigma will protrude and retire with every movement of the wing.

comparable to the water pouring out at the end of a hollow Archimedean screw.

Fruits.—The screw is beautifully illustrated by the fruits of the Stork's-bill (*Erodium*), the Feather-grass (*Stipa*), and the Oat. (Figs. 299, 300.) The first-named fruit consists of five carpels, separating from each other when ripe, and having the long part above the ovary (really consisting of the margins of the carpel) twisted. If it be moistened, the outer side of the awn-like beak contracts, and the pseudo-awn then begins to untwist and elongate itself. Since, too, the ovary and beak are both covered with erect hairs, they act like anchors, and so give the fruit a "purchase," with the aid of which it screws itself into the ground.

We have seen how parts of flowers become subject to tensions during growth, so that when complete they are in a condition of unstable equilibrium, as the staminal tube of species of *Medicago*, which, when it has sprung into its curved form, cannot be restored to its original horizontal position.

A similar tension may occur in fruits. Thus, in the Squirting

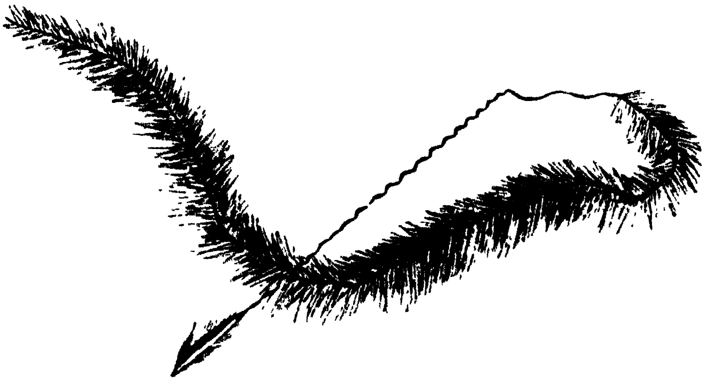


FIG. 300.—Fruit of Feather-grass (*Stipa pennata*), showing spirally twisted awn and sharp-pointed grain. (After Lubbock.)

Cucumber the fruit is continually becoming more and more turgid with juice as it increases in size. The tough rind prevents its bursting under pressure, but when it is ripe the fruit gives way at the stalk and contraction immediately follows, so that the watery matter, with the seeds, is squirted out to a considerable distance.

On the other hand, many dry fruits acquire a condition of unstable equilibrium through the loss of water by evaporation. The tissue contracts and the carpels burst open with violence, often ejecting the seeds to considerable distances. Geraniums, Violets, Balsams, many of the *Euphorbia* family, &c., discharge their seeds in this way; but in the Wood-sorrel it is the coat of the seed itself which, splitting and rolling back, throws the seed out of the capsule.

In order to resist the strain of the weight of a fruit as it increases in size, the petiole becomes stronger and stronger till the fruit be ripe; and then the contrary takes place and the fruit falls.

Attention may here be called to a curious result of the distribution of forces and the consequent structure of many Pears (fig. 301). If, like

Apples, they hang vertically, the fruit is perfectly symmetrical in shape. But if the stalk stand obliquely from the branch, as the Pear increases in weight, it tends to break away at the insertion of the stalk in the Pear, as can be easily seen from the adjoined figure of a Dr. Jules Guyot Pear:—

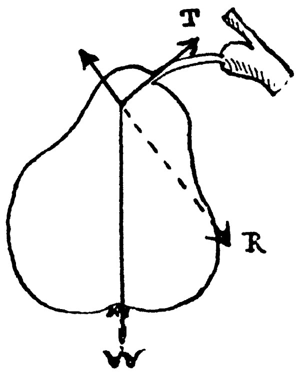


FIG. 301.—Dr. Jules Guyot Pear, showing distribution of forces to account for want of symmetry at point of attachment to stalks.

To resist this strain (that is, the *resultant* of the *weight* of the Pear and the *tension* along the stalk), a hump grows out at the base of the Pear on the side away from the tree, thus preventing rupture at this point.

Cells and Vessels.—It is not only in conspicuous organs, or even in the distribution of fibro-vascular bundles in leaves, petioles and stems, where strengthening structures are developed, to bear weights or resist strains,

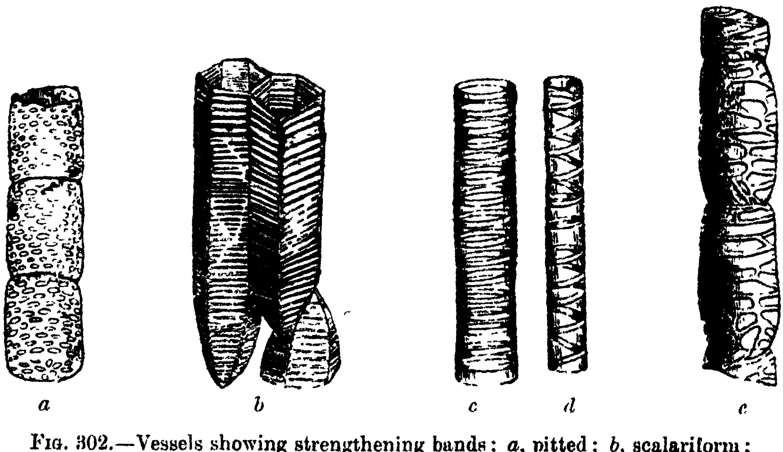


FIG. 302.—Vessels showing strengthening bands: *a*, pitted; *b*, scalariform; *c*, ringed; *d*, spiral; *e*, reticulated.

but abundant illustrations might be taken from the microscopic tissues of plants.

Cells and vessels are frequently strengthened in various ways (fig. 302). Thus the first-formed vessels of a stem have a spiral fibre running up the inner side; hence (*d*) they are called "spiral vessels"; sometimes the strengthening is deposited in rings (*c*); occasionally both these kinds of

thickening are to be seen in the same vessel. In a third kind of vessel it takes the form of a net (*c*), and it is then called a "reticulated vessel." A fourth kind of vessel is thickened all over the inner surface, *except* at a number of places which give the appearance of holes. It is then called a "punctated vessel" (*a*). Lastly, in Ferns, a common form of vessel is to have the thickening material deposited in bars. It is then called "scalariform," as resembling a ladder (*b*).

These cases will be sufficient for the reader to understand the general, or indeed universal law of Nature, that, whatever strength is required, she at once proceeds to supply it in some way or other as may be best adapted to each individual case.

Pyrus japonica nivalis. (*Journal of Horticulture.*)

MENDEL'S "LAW" APPLIED TO ORCHID HYBRIDS.

By Capt. C. C. HURST, F.L.S., F.R.H.S.

(First Paper.)

MENDEL's formula, for the separation of characters in crosses, was first enunciated in 1865 (Nos. 17-19).* Since that time it appears to have been lost in obscurity, until brought to light by the researches and experiments of Prof. Hugo de Vries, early in 1900. (Nos. 8-12.)

De Vries' experiments confirmed Mendel's formula in many widely different genera, including *Agrostemma, Chelidonium, Hyoscyamus, Lychnis, Œnothera, Papaver, Zea, Aster, Chrysanthemum, Coreopsis, Solanum, Veronica, Viola, Clarkia, Silene, Datura,* and *Trifolium.* (Nos. 8 12.)

Soon afterwards some of Mendel's original experiments with Peas were repeated and confirmed by both Correns (Nos. 3-7) and Tschermak (Nos. 20-22). (See also Bateson, Nos. 1-2.)

Mendel's formula may be simply stated as follows: --If two distinct but corresponding characters, A and a, be united by crossing, and the resulting crosses be self-fertilised, the progeny as regards this pair of characters will separate themselves according to the formula A + 2Aa + a. That is to say, on the average, out of every four plants raised, one will take after the original character A, two will be intermediate Aa, and one will take after the original character a. In other words, one-half will retain the original characters, and one-half will be intermediate. This formula of Mendel, having been confirmed by three independent observers and extended to no fewer than sixteen distinct genera, is evidently of great importance.

The next question is, How far can Mendel's formula be extended to other genera and to other kinds of crosses?

With regard to this, a careful study of the above experiments suggests the following observations:—

(1) Racial characters alone have formed the basis of all the experiments.

(2) Pairs of distinct though corresponding characters are dealt with as separate units, while the individual plant, made up of many characters, is ignored.

(3) Each character of the pair is not only distinct from the other, but seems to be antagonistic to it; for in each pair one character has in all the experiments been dominant in the first generation, to the exclusion of the other, *i.e.* the recessive one, which latter does not show itself until the second generation.

(4) The dominant character has in all cases been the *older and typical one,* the recessive character being recently descended from the dominant one.

We may therefore, I think, fairly conclude that, as far as the first generation is concerned, the experiments of Mendel and others mentioned

* The Nos. refer to list of Authors on p. 694.

above are abnormal and exceptional, owing to the peculiar kinds of elements made use of, and therefore, for the present, they may be disregarded altogether.

Yet, notwithstanding this, the results of Mendel's experiments in the second generation are highly important, and suggest a formula which I believe may be greatly extended in its application.

Unfortunately, Mendel's formula and Mendel's theory in explanation of that formula have hitherto been regarded together and put forward as the same thing, under the name of Mendel's law. It has already been shown in a large number of cases that Mendel's formula is an undoubted reality as a working formula for the *separation of characters in self-fertilised crosses.*

In the following observations in regard to Orchid hybrids I propose to show that this working formula of Mendel may, with certain modifications, be extended to the *union of specific characters in intermediate primary hybrids.*

At the same time I have reason to believe that the application of Mendel's formula is strictly limited to hybrids and crosses of *a certain ancestry.* I hope to show, further, that Mendel's theory, in explanation of his formula, cannot generally be maintained with Orchid hybrids; and, finally, that Mendel's formula is not a general law, but simply a particular formula for a particular group of hybrids and crosses.

First, in regard to the extension of Mendel's formula to the union of specific characters in primary hybrids.

In order to clear the way for the details of my observations in Orchid hybrids, I will offer a few remarks on the nature of those observations, which may possibly serve to anticipate and meet several objections similar to those that have been already made to the experiments of Mendel and others.

The Advantages of Orchid Hybrids for Observations in Heredity.

My own experiments and observations in hybridisation have, for the most part, been deliberately confined to hybrids between distinct species in the natural order *Orchideæ*; these seem to me to offer distinct advantages to the student of heredity, for the following reasons:—

1. The natural order *Orchideæ* contains a large number of genera and species, with a wide range of variation.

2. Many of the species have attained to a high degree of specialisation among flowering plants.

3. Orchid hybrids, between distinct species and even genera, are now very numerous in gardens, and, as a rule, are very fertile as compared with some plant hybrids.

4. Orchid hybrids being valuable commercially, their pedigrees are, as a rule, carefully kept; and the literature devoted to them is very extensive, containing not only written records, but also valuable reproductions of paintings, photographs, and drawings, all of which are, and will be, invaluable for future reference.

5. Orchid hybridisation has progressed so rapidly of late that we have already complex hybrids combining in their pedigree no less than five

distinct species, and further developments are confidently anticipated in a very short time.

6. True specific characters are more easy to follow in a complex hybrid than varietal or even racial ones.

7. In isolated Orchid species the pedigree of pure specific characters is known to have been the same for many generations, thus being less liable to reversion than mere racial or varietal characters, whose origin is comparatively recent.

The Union of Specific Characters in Intermediate Primary Hybrids.

If two distinct species of Orchids of the same genus be crossed together, the resulting hybrid is, as a whole, fairly intermediate between the two parent species, e.g. *Paphiopedilum* (*Cypripedium*) *Spicerianum* × *P. insigne* = *P.* × *Leeanum* (Nos. 13-16). But if, according to Mendel's system, the inheritance of each pair of specific characters be examined separately in a number of plants, it is found that the character of each species is, as a rule, inherited in different degrees by the hybrids. *E.g.* the typical *P. insigne* has a number of well-defined spots on the upper sepal of the flower, while in *P. Spicerianum* these are quite absent.

In this particular character the individual hybrids between these two species (i.e. *P.* × *Leeanum*) differ considerably among themselves, even if raised from the same capsule: (1) A *few* of them show spots equal in size and number to the typical *P. insigne* parent. (2) A *few*, on the other hand, show no spots whatever, as in the parent *P. Spicerianum*. (3) A *few* are exactly intermediate between the two parents, inasmuch as they show spots reduced, in size and number, to one half. (4) The *great majority*, however, vary in degree on either side of the true intermediate form, up to each of the parental extremes, thus, altogether, making a perfect series of intermediate forms between the two parent species.

As it is with the spots on the upper sepal, so it is with the other characters of *P.* × *Leeanum*, both in colour and form.

As it is with *P.* × *Leeanum*, so it is, as a rule, with other intermediate hybrids in Orchids. Judging from my own experience, it is probable that this rule might be safely extended to most intermediate hybrids in both plants and animals, but for the present I will confine myself to Orchids.

This complete series of intermediate forms between the two extreme parents A and a, for each pair of specific characters, is somewhat difficult to classify with any precision. The word "intermediate," as generally used to describe the phenomenon, is too elastic and vague for practical use.

Thus any one form in the series, however near it might be to either A or a, might be called "intermediate," while, on the other hand, if we apply the term in a strict sense, only to those forms exactly midway between A and a, we should probably not get more than one per cent. truly intermediate, and this would be too precise, or rather too pedantic, for practical use. In order to avoid this ambiguity, for the purpose of this paper, I propose to define "intermediate" as follows:—

In the series of forms between A and a, all those that show $\frac{3}{4}$ *A and*

more I will term A. Likewise, all those that show $\frac{3}{4}$ *a and more,* I will term a.

The remainder, lying between $\frac{3}{4}$ A and $\frac{3}{4}$ a, I will term "intermediate" or A a.

I admit that this classification is far from perfect, but it seems to be sufficiently precise for practical purposes.

Following out this classification, I have carefully analysed the inheritance of pairs of specific characters in many distinct hybrids belonging to several genera in the *Orchideæ.*

In all cases I have been careful to actually compare the hybrids with their parents, mostly from living plants in my own collection, others from photographs or reliable coloured drawings. For the sake of clearness, I will repeat that, according to Mendel's system, single characters only are dealt with in a number of plants, the individual plant made up of many characters in this case being ignored as a unit, though at the same time the many specific characters of a plant have been utilised *separately* in the analyses to make up the result.

The following is a detailed list of the analyses, giving—

(1) The name of the hybrid.

(2) The names of the parents.

(3) The numbers of the "specifics"—*i.e.* those characters that in the analyses are classed as either A or a.

(4) The numbers of the "intermediates"—*i.e.* those characters that in the analyses are classed as Aa.

Hybrid	Parents	"Specifics"	"Intermediates"
Calanthe × Veitchii	C. rosea × C. vestita	6	6
Cattleya × Atalanta	C. Leopoldi × C. Warscewiczii	10	14
C. × Browniæ	C. Bowringiana × C. Loddigesii	6	4
C. × calummata	C. Acklandiæ × C. intermedia	14	12
C. × Cecilia	C. Lawrenceana × C. Trianæi	4	10
C. × Ella	C. bicolor × C. Warscewiczii	6	6
C. × Goossensiana	C. Gaskelliana × C. Schilleriana	5	6
C. × Harrisiæ	C. Mossiæ × C. Schilleriana	22	18
C. × Iris	C. bicolor × C. Dowiana	14	10
C. × Mantinii	C. Bowringiana × C. Dowiana	13	11
C. × Maroni	C. Dowiana × C. velutina	6	6
C. × Portia	C. Bowringiana × C. labiata	8	6
C. × Rothwelliæ	C. Bowringiana × C. Eldorado	8	5
C. × Rothschildiana	C. Dowiana × C. Gaskelliana	10	6
C. × Wendlandii	C. Bowringiana × C. Warscewiczii	6	8
Cymbidium × eburneo-Lowianum	. . . .	18	14
Dendrobium × Ainsworthii	D. aureum × D. nobile	22	14
D. × Aspasia	D. aureum × D. Wardianum	6	6
D. × Schneiderianum	D. aureum × D. Findlayanum	4	6
Epi-Lælia × Hardyana	E. ciliare × L. anceps	8	4
Lælia × Diana	L. Dayana × L. purpurata	12	10
L. × Latona	L. cinnabarina × L. purpurata	4	8
L. × nigrescens	L. purpurata × L. tenebrosa	2	4
L. × purpurato-grandis	. . . .	6	6
Lælio-Cattleya × Aurora	C. Loddigesii × L. Dayana	10	10
L.-C. × bletchleyensis	L. tenebrosa × C. Warscewiczii	4	2
L.-C. × callistoglossa	L. purpurata × C. Warscewiczii	4	8
L.-C. × Canhamiana	L. purpurata × C. Mossiæ	6	6
L.-C. × corbeillensis	C. Loddigesii × L. pumila	8	4

Hybrid	Parents	"Specifics"	"Intermediates"
L.-C. × Dominiana	C. Dowiana × L. purpurata	10	8
L.-C. × Digbyano-Mendelii	. . . .	10	2
L.-C. × Ingramii	C. Dowiana × L. Dayana	4	8
L.-C. × intermedio-flava	. . . .	6	6
L.-C. × Leucasta	C. bicolor × L. harpophylla	4	2
L.-C. × Maronæ	C. Warscewiczii × L. Digbyana	4	6
L.-C. × Massangeana	C. Schilleriana × L. tenebrosa	6	6
L.-C. × Myra	C. Trianæi × L. flava	8	4
L.-C. × Nysa	C. Warscewiczii × L. crispa	8	6
L.-C. × Pallas	C. Dowiana × L. crispa	2	10
L.-C. × Proserpine	C. velutina × L. Dayana	8	4
L.-C. × Roeblingii	C. Gaskelliana × L. purpurata	4	2
L.-C. × Sallierii	C. Loddigesii × L. purpurata	8	4
L.-C. × Wilsonæ	C. labiata × L. Dayana	4	2
L.-C. × Wrigleyi	C. Bowringiana × L. anceps	10	8
Miltonia × Bleuana	M. Roezlii × M. vexillaria	20	16
Odontoglossum × Rolfeæ	O. Harryanum × O. Pescatorei	8	12
O. × spectabile	O. crispum × O. Harryanum	12	11
Paphiopedilum × Allanianum	P. Curtisii × P. Spicerianum	52	46
P. × Annie Measures	P. bellatulum × P. Dayanum	8	12
P. × apiculatum	P. barbatum × P. Boxallii	16	24
P. × Argo-Rothschildianum	. . . .	18	22
P. × Arthurianum	P. Fairrieanum × P. insigne	38	42
P. × Ashburtoniæ	P. barbatum × P. insigne	82	78
P. × Bleui	P. ciliolare × P. insigne	12	8
P. × bruxellense	P. Rothschildianum × P. venustum	16	20
P. × Calypso	P. Boxallii × P. Spicerianum	42	58
P. × Canhami	P. superbiens × P. villosum	54	46
P. × Celia	P. Spicerianum × P. tonsum	10	6
P. × Ceres	P. hirsutissimum × P. Spicerianum	22	18
P. × conco-Lawre	. . . .	4	6
P. × Chapmanii	P. bellatulum × P. Curtisii	8	12
P. × conco-villosum	. . . .	18	22
P. × Crossianum	P. insigne × P. venustum	56	64
P. × Deedmanianum	P. Chamberlainianum × P. Spicerianum	18	22
P. × Doncasterianum	P. callosum × P. hirsutissimum	48	32
P. × Druryo-Hookeræ	. . . .	12	8
P. × Edwardii	P. Fairrieanum × P. superbiens	4	4
P. × Endymion	P. barbatum × P. Mastersianum	6	10
P. × Eucharis	P. insigne × P. Lawrenceanum	16	24
P. × Euryandrum	P. barbatum × P. Stonei	12	8
P. × Eyermanianum	P. barbatum × P. Spicerianum	8	12
P. × Godseffianum	P. Boxallii × P. hirsutissimum	18	22
P. × Gravesiæ	P. Argus × P. niveum	4	4
P. × Harrisianum	P. barbatum × P. villosum	64	76
P. × Helios	P. Curtisii × P. villosum	62	58
P. × Hitchinsiæ	P. Charlesworthii × P. insigne	4	4
P. × Helvetia	P. Chamberlainianum × P. philippinense	8	12
P. × Indra	P. callosum × P. villosum	129	141
P. × Joliboisii	P. Curtisii × P. Lowii	10	10
P. × Lathamianum	P. Spicerianum × P. villosum	154	152
P. × Lairessei	P. Curtisii × P. Rothschildianum	12	8
P. × Lawrenceano - Mastersianum	. . . .	36	44
P. × Leeanum	P. insigne × P. Spicerianum	248	244
P. × Mahleræ	P. Lawrenceanum × P. Rothschildianum	12	8
P. × Greyanum	P. ciliolare × P. Druryi	6	4
P. × microchilum	P. Druryi × P. niveum	10	10
P. × Morganiæ	P. Stonei × P. superbiens	16	24
P. × Niobe	P. Fairrieanum × P. Spicerianum	20	30
P. × nitens	P. insigne × P. villosum	96	104
P. × Olenus	P. bellatulum × P. ciliolare	10	8
P. × Paris	P. bellatulum × P. Stonei	2	6
P. × politum	P. barbatum × P. venustum	22	18
P. × polystigmaticum	P. Spicerianum × P. venustum	4	5

Hybrid	Parents	"Specifics"	"Intermediates"
P. × porphyrochlamys	P. barbatum × P. hirsutissimum	4	4
P. × Quies	P. Curtisii × P. Hookeræ	42	38
P. × Richmanii	P. barbatum × P. bellatulum	16	20
P. × Rolfei	P. bellatulum × P. Rothschildianum	6	4
P. × selligerum	P. barbatum × P. philippinense	56	44
P. × superciliare	P. barbatum × P. superbiens	32	28
P. × Swinburnei	P. Argus × P. insigne	26	34
P. × Tautzianum	P. barbatum × P. niveum	6	4
P. × tessellatum	P. barbatum × P. concolor	10	10
P. × vexillarium	P. barbatum × P. Fairrieanum	14	10
P. × Vipani	P. niveum × P. philippinense	4	6
P. × Winnianum	P. Druryi × P. villosum	24	16
P. × Youngiæ	P. bellatulum × P. Hookeræ	10	6
P. × Youngianum	P. superbiens × P. philippinense	14	12
Phragmipedilum × Cleola	P. Boissierianum × P. Schlimii	8	6
P. × Dominianum	P. caricinum × P. caudatum	22	18
P. × grande	P. caudatum × P. longifolium	8	6
P. × Sedenii	P. longifolium × P. Schlimii	36	34
Sobralia × Veitchii	S. macrantha × S. xantholeuca	16	20
Zygopetalum × Perrenoudi	Z. Gautieri × Z. intermedium	12	4
	Total	2,281	2,267

The results of the analyses given above may be summarised as follows:—

Out of 4,548 pairs of specific characters united by hybridisation, 2,281 are classed as "specifics" and 2,267 as "intermediates." In other words, we find that specific characters, taken singly, associate themselves approximately in intermediate hybrids at the rate of one-half "specifics" and one-half "intermediates."

Now if A and a represent the "specifics" generally, and Aa the "intermediates," we get the formula 1,141 A + 2,267 Aa + 1140 a, which, simplified, becomes approximately A + 2Aa + a.

That the "specifics" together are made up on the average of equal numbers of A and a the following instance will show:—

Take, e.g., *Paphiopedilum* × *Leeanum*. In this case a large number of hybrids were analysed, giving in all 492 characters. Of these 248 were "specifics" and 244 were "intermediates." Of the 248 "specifics," 127 were *P. Spicerianum* and 121 *P. insigne*.

Now if *P. Spicerianum* = A, and *P. insigne* = a, the precise formula in this case works out as 127 A + 244 Aa + 121 a, which, considering the small numbers used, is a close approximation to A + 2Aa + a.

Thus we see that the above formula for the union of specific characters in intermediate Orchid hybrids is practically the same as Mendel's formula for the separation of characters in crosses with Peas.

In the next paper I will endeavour to show that this formula of Mendel, though useful as working formula for hybrids of a certain ancestry, has its limitations; and that Mendel's theory in explanation of that formula cannot generally be maintained with Orchid hybrids.

(Since the above was written, an important paper on the subject, by Prof. W. F. R. Weldon, F.R.S., has appeared, which deserves careful

study. (*No.* 28.) *After doing full justice to the labours of Mendel and others, Prof. Weldon gives a number of apparent exceptions to Mendel's law in regard to Peas, and suggests that in former experiments sufficient attention has not been given to the important question of ancestry. With this I agree, and submit that the experiments with Orchid hybrids detailed above are not open to this objection.—C. C. H.*)

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LÆLIO-CATTLEYA "LEUCASTA." (*Gardener's Magazine.*)

LIST OF ORCHIDS

Used in the fertilisation of Hybrids which have received either First-class Certificates or Awards of Merit from the ROYAL HORTICULTURAL SOCIETY, *to December* 31, 1901.

Compiled by J. GURNEY FOWLER, Treasurer.

THE FOLLOWING ABBREVIATIONS ARE USED IN THIS LIST.

B.	=Brassavola	*L.*	=Lælia
B.-C.	=Brasso-Cattleya	*L.-C.*	=Lælio-Cattleya
B.-C.-L.	=Brasso-Catt-Lælia	*P.*	=Phaius
C.	=Cattleya	*P.-C.*	=Phaio-Calanthe
Cal.	=Calanthe	*S.*	=Sophronitis
Col.	=Colax	*S.-C.*	=Sophro-Cattleya
E.	=Epidendrum	*S.-L.*	=Sophro-Lælia
E.-C.	=Epi-Cattleya	*S.-L.-C.*	=Sophro-Lælio-Cattleya
E.-L.	=Epi-Lælia	*Z.-C.*	=Zygo-Colax

In cases where none of the foregoing letters precede the name, the generic name is the same as that of the genera being classified.

The number following the name of the hybrid records the number of paintings, either of it or of its varieties, which are in the Royal Horticultural Society's Collection of Paintings.

ANGRÆCUM

eburneum	sesquipedale	Veitchii (1)
sesquipedale	eburneum	Veitchii (1)

ANGULOA

Clowesii	Ruckeri	intermedia
Ruckeri	Clowesii	intermedia

BRASSAVOLA

fragrans	*C.* intermedia	*B.-C.* nivalis (1)

BRASSO-CATTLEYA

Lindleyana	*L.-C.* elegans (nat. hyb.)	*B.-C.-L.* Lindleyano-elegans (1)

CALANTHE

bella vestita Turneri Veitchii rosea vestita	Veitchii rosea vestita	Florence
Baron Schröder Regnierii vestita rubro-oculata gigantea	*P.* Wallichii	*P.-C.* Schröderiana (1)
Bryan vestita rubro-oculata Williamsii	rosea	splendens (1)
„	*P.* grandifolius	*P.-C.* grandis (1)
furcata	Masuca	Dominii
gigas Sanderiana vestita rubro-oculata gigantea	*P.* grandifolius	*P.-C.* Niobe (1)
labrosa	vestita rubro-oculata	porphyrea
Masuca	furcata	Dominii
„	tricarinata	Masuco-tricarinata
Regnierii	vestita rubro-oculata gigantea	Baron Schröder
„	*P.* grandifolius	*P.-C.* Arnoldiae
rosea	Bryan vestita rubro-oculata Williamsii	splendens (1)
„	Veitchii rosea vestita	Victoria Regina
„	vestita	Veitchii (2)
„	vestita rubro-oculata	Sandhurstiana
Sanderiana	vestita rubro-oculata gigantea	gigas
tricarinata	Masuca	Masuco-tricarinata
Veitchii rosea vestita	bella vestita Turneri Veitchii rosea vestita	Florence
„	rosea	Victoria Regina
„	vestita	burfordiensis (1)
„	„	sanguinaria (1)
„	„ luteo-oculata	Cooksonii
„	„ „	Hallii
„	„ rubro-oculata	Alexanderi
„	„ „	Harold
„	„ „	Sedenii
„	„ Turneri	bella
„	„ „	Harrisii (1)
„	„ „ nivalis	Mylesii
„	*P.* grandifolius	*P.-C.* Sedeniana
vestita	rosea	Veitchii (2)
„	Veitchii vestita rosea	burfordiensis (1)
„	„	sanguinaria (1)
„ luteo-oculata	„	Cooksonii
„ „	„	Hallii
„ rubro-oculata	labrosa	porphyrea
„ „	rosea	Sandhurstiana

CALANTHE—*continued.*

vestita rubro-oculata . .	Veitchii	Alexanderi
	{ vestita { rosea	
„ „ . .	„	Harold
„ „ . .	„	Sedenii
„ „ . .	Williamsii	Bryan
„ „ . .	„	Wm. Murray
„ „ . .	*P.* grandifolius	*P.-C.* irrorata purpurea
„ „ gigantea	Regnierii	Baron Schröder
„ „ „	Sanderiana	gigas
„ Turneri	Veitchii	bella
	{ vestita { rosea	
„ „	„	Harrisii (1)
„ „ nivalis .	„	Mylesii
„ „ „ .	*P.* grandifolius	*P.-C.* irrorata
Williamsii	vestita rubro-oculata . .	Bryan
„	„ „ . .	Wm. Murray

CATTLEYA

Aclandiæ	Forbesii	quinquecolor
„	intermedia	calummata
„	labiata	Eurydice
„	Loddigesii	Brabantiæ
„	Mossiæ	Apollo
„	Trianæi	Lottie (1)
„	Warscewiczii	Fernand Denis (1)
„	*L.* cinnabarina	*L.-C.* Adolphus (1)
„	*L.* tenebrosa	*L.-C.* Remula (1)
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Philbrickiana
„	*S.* grandiflora	*S.-C.* George Hardy (2)
bicolor	Dowiana aurea	Iris (2)
„	Warscewiczii	Ella (1)
„	*L.* pumila præstans . .	*L.-C.* præstans-bicolor (1)
„	*L.* xanthina	*L.-C.* Elstead Gem
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Andreana (1)
Bowringiana	Dowiana aurea	Mantinii (1)
„	guttata	Bactia (1)
„	Hardyana Massaiana . .	Mrs. J. W. Whiteley (1)
	{ Warscewiczii { Dowiana aurea	
„	Harrisoniana	Browniæ (1)
„	labiata	Portia (1)
„	maxima	Chloris
„	Warscewiczii	Wendlandii
„	*E.* O'Brienianum . . .	*E.-C.* Mrs. James O'Brien (1)
	{ *E.* evectum { *E.* radicans	
„	*E.* radiatum	*E.-C.* radiato-Bowringiana (1)
„	*L.* pumila	*L.-C.* Parysatis
„	*L.-C.* Dominiana . . .	Ilione (1)
	{ *L.* purpurata { *C.* Dowiana aurea	
„	*L.-C.* elegans Turneri (nat. hyb.)	*L.-C.* Tiresias (1)
„	*S.* grandiflora	*S.-C.* eximia
nat. hyb.) .	*L.-C.* elegans (nat. hyb.)	*L.-C.* Duke of York

CATTLEYA—*continued.*

calummata	Mossiæ Wageneri	Parthenia
{ intermedia Aclandiæ		
„	*S.* grandiflora	*S.-C.* Nydia (1)
chocoensis	guttata Leopoldii	Mitchelli
citrina	intermedia	Lamberhurst hybrid
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Seraph
dolosa	*L.* Dayana	*L.-C.* Maynardi
Dowiana	guttata Leopoldii	Chamberlainiana
„	*L.* crispa	*L.-C.* Pallas
„	*L.* purpurata	*L.-C.* Dominiana (3)
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Berthe Fournier (2)
„	*L.-C.* Schilleriana	*L.-C.* Lucilia (1)
	{ *L.* purpurata *C.* intermedia	
„ aurea	bicolor	Iris (2)
„ „	Bowringiana	Mantinii (1)
„ „	Eldorado	Lady Ingram (1)
„ „	Forbesii	fulvescens (1)
„ „	Gaskelliana	Lord Rothschild
„ „	labiata	Fabia (1)
„ „	Luddemanniana	Kienastiana (1)
„ „	maxima	vestalis (1)
„ „	Mossiæ	Empress Frederick (1)
„ „	Schilleriana	F. W. Wigan (1)
„ „	Trianæi	Maggie Raphael (1)
„ „	velutina	Maronii (1)
„ „	Warscewiczii	Hardyana (3)
„ „	*L.* cinnabarina	*L.-C.* Charlesworthii (1)
„ „	*L.* Dayana	*L.-C.* Ingramii (1)
„ „	*L.* Perrinii	*L.-C.* Decia
„ „	*L.* pumila præstans	*L.-C.* Clive
„ „	*L.* tenebrosa	*L.-C.* luminosa (1)
„ „	*L.* xanthina	*L.-C.* Ophir (1)
Eldorado	Dowiana aurea	Lady Ingram (1)
„	*L.* crispa	*L.-C.* Pisandra
Forbesii	Aclandiæ	quinquecolor
„	Dowiana aurea	fulvescens (1)
„	Mendelii	Melpomene (1)
Gaskelliana	Dowiana aurea	Lord Rothschild
„	superba	mollis (1)
„	Warscewiczii	Harold
„	*L.* crispa	*L.-C.* Bryan (1)
„	*L.* Dayana	*L.-C.* Eunomia
„	*L.* Digbyana	*L.-C.* Thortonii (1)
„	*L.* Perrinii	*L.-C.* Semiramis (1)
„	*L.* purpurata	*L.-C.* Violetta (1)
„	*L.* purpurata alba	*L.-C.* C. G. Roebling
„	*L.* xanthina	*L.-C.* The Hon. Mrs. Astor
granulosa Schofieldiana	Hardyana	Germania (1)
	{ Dowiana aurea Warscewiczii	
„ „	Mendelii	weedoniensis (1)
„ „	*L.* Dayana	*L.-C.* Galatea (1)
„ „	*L.* xanthina	*L.-C.* Robin Measures (1)
guttata	Bowringiana	Bactia (1)
„	*L.* cinnabarina	*L.-C.* Vacuna (1)
„ Leopoldii	chocoensis	Mitchelli
„ „	Dowiana aurea	Chamberlainiana

CATTLEYA—*continued.*

guttata Leopoldii	Hardyana (Dowiana aurea / Warscewiczii)	Fowlerii
„ „	Mendelii	Harrisii
„ „	Warscewiczii	Atalanta
„ „	*S.* grandiflora	*S.-C.* Cleopatra (1)
„ Prinzii	Trianæi	Miranda (1)
Hardyana (Dowiana aurea / Warscewiczii)	granulosa Schofieldiana	Germania (1)
„	guttata Leopoldii	Fowlerii
„	*L.* tenebrosa	*L.-C.* Haroldiana (2)
„	*L.-C.* Schilleriana (*L.* purpurata / *C.* intermedia)	*L.-C.* Henry Greenwood (2)
„ Massaiana	Bowringiana	Mrs. J. W. Whiteley (1)
Harrisoniana	Bowringiana	Browniæ (1)
„	Warscewiczii	Ashtonii
„	*S.* grandiflora	*S.-C.* Chamberlainiana (1)
intermedia	Aclandiæ	calummata
„	citrina	Lamberhurst hybrid
„	maxima	Dominiana
„	superba	porphyrophlebia (1)
„	Trianæi	Olivia
„	*B.* fragrans	*B.-C.* nivalis (1)
„	*L.* flava	*L.-C.* intermedio-flava (1)
„	*L.* purpurata	*L.-C.* Schilleriana (1)
„	*L.-C.* elegans Turneri	*L.-C.* Cicero
„	*S.* grandiflora	*S.-C.* Batemaniana
intricata	superba	Burberryana
iricolor	Mossiæ	Philo
labiata	Aclandiæ	Eurydice
„	Bowringiana	Portia (1)
„	Dowiana aurea	Fabia (1)
„	Loddigesii	Marstersoniæ
„	*L.* crispa	*L.-C.* Veitchiana
„	*L.* Dayana	*L.-C.* Wilsoniæ (1)
„	*L.* Perrinii	*L.-C.* Statteriana
„	*L.* purpurata	*L.-C.* bella
„	„	*L.-C.* Wellsiæ
„	*L.-C.* exoniensis (nat. hyb.)	*L.-C.* Fanny Leon (1)
„ flammea	*L.* tenebrosa	*L.-C.* Lucasiana (1)
Lawrenceana	Lüddemanniana	Triumph
„	Mendelii	Wm. Murray
„	Mossiæ	Lawre-Mossiæ
„	Percivaliana	Sedenii (1)
„	Trianæi	Cecilia
„	Warscewiczii	Jupiter
„	*L.* cinnabarina	*L.-C.* highburiensis
„	*L.* purpurata	*L.-C.* Hyeana (1)
Loddigesii	Aclandiæ	Brabantiæ
„	labiata	Marstersoniæ
„	Lüddemanniana	Manglesii
„	Warscewiczii	Minucia
„	*L.* crispa	*L.-C.* Tresederiana
„	*L.* Dayana	*L.-C.* Aurora
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Behrensiana
„	*L.-C.* elegans Turneri (nat. hyb.)	*L.-C.* Pytho
„	*L.-C.* exoniensis (nat. hyb.)	*L.-C.* fausta

CATTLEYA—*continued.*

Loddigesii	*L.-C.* fausta	*L.-C.* leucoglossa
	{ *C.* Loddigesii { *L.-C.* exoniensis (nat. hyb.)	
„	*S.* grandiflora	*S.-C.* Calypso
Lüddemanniana	Dowiana aurea	Kienastiana (1)
„	Lawrenceana	Triumph
„	Loddigesii	Manglesii
„	Trianæi	Princess (1)
„	*L.* Dayana	*L.-C.* Timora
„	*L.* Perrinii	*L.-C.* Hermione (1)
„	*L.* purpurata	*L.-C.* Duvaliana
„	*L.-C.* elegans (nat. hyb.).	*L.-C.* Mardelii
maxima	Bowringiana	Chloris
„	Dowiana aurea	vestalis (1)
„	intermedia	Dominiana
„	Skinneri	Eclipse
„	*L.* crispa	*L.-C.* Amesiana
„	*L.-C.* elegans (nat. hyb.)	*L.-C.* Chas. Darwin
Mendelii	Forbesii	Melpomene (1)
„	granulosa Schofieldiana	weedoniensis (1)
„	guttata Leopoldii	Harrisii
„	Lawrenceana	Wm. Murray
„	*L.* Digbyana	*L.-C.* Digbyano-Mendelii (3)
„	*L.* purpurata	*L.-C.* Aphrodite (5)
„	*L.* xanthina	*L.-C.* Zephyra
Mossiæ	Aclandiæ	Apollo
„	Dowiana aurea	Empress Frederick (1)
„	iricolor	Philo
„	Lawrenceana	Lawre-Mossiæ
„	Schilleriana	Miss Harris (1)
„	Walkeriana	Eros
„	Warneri	intertexta (1)
„	*L.* cinnabarina	*L.-C.* Hippolyta (2)
„	*L.* Digbyana	*L.-C.* Digbyano-Mossiæ
„	*L.* majalis	*L.-C.* Juno (1)
„	*L.* purpurata	*L.-C.* Canhamiana (3)
„	*L.* tenebrosa	*L.-C.* Martineti (1)
„	*L.-C.* Gottoiana	*L.-C.* Wiganiæ (1)
	{ *L.* tenebrosa { *C.* Warneri	
„	*S.* grandiflora	*S.-C.* Queen Empress (1)
„ Reineckiana	Schilleriana	elatior (1)
„ Wageneri	calummata	Parthenia
	{ *C.* intermedia { *C.* Aclandiæ	
O'Brieniana (nat. hyb.)	*L.-C.* elegans Turneri (nat. hyb.)	*L.-C.* Hérode (1)
Percivaliana	Lawrenceana	Sedenii (1)
„	Trianæi	Adela (1)
„	*L.* flava	*L.-C.* Ernestii (1)
Schilleriana	Dowiana aurea	F. W. Wigan (1)
„	Mossiæ	Miss Harris (1)
„	„ Reineckiana	elatior (1)
„	Trianæi	Elvina
Schröderæ	Warscewiczii	H. S. Leon (1)
„	*L.* cinnabarina	*L.-C.* G. S. Ball (1)
„	*L.* purpurata	*L.-C.* Fascinator (1)
Skinneri	maxima	Eclipse
„	*L.* flava	*L.-C.* Marriottiana

CATTLEYA—*continued.*

superba	Gaskelliana	mollis (1)
,,	intermedia	porphyrophlebia (1)
,,	intricata	Burberryana
,,	Warscewiczii	Euphrasia (1)
,,	*L.* cinnabarina	*L.-C.* Sunray (1)
,,	*L.-C.* elegans (nat. hyb.)	*L.-C.* Sedenii
,,	*L.-C.* exoniensis (nat. hyb.)	*L.-C.* triophthalma
Trianæi	Aclandiæ	Lottie (1)
,,	Dowiana aurea	Maggie Raphael (1)
,,	guttata Prinzii	Miranda (1)
,,	intermedia	Olivia
,,	Lawrenceana	Cecilia
,,	Lüddemanniana	Princess (1)
,,	Percivaliana	Adela (1)
,,	Schilleriana	Elvina
,,	*L.* anceps	*L.-C.* Frederick Boyle (1)
,,	*L.* cinnabarina	*L.-C.* warnhamiensis (2)
,,	*L.* Digbyana	*L.-C.* Digbyano-Trianæi (1)
,,	*L.* flava	*L.-C.* Myra (1)
,,	*L.* harpophylla	*L.-C.* Doris
,,	*L.* Jongheana	*L.-C.* Baroness Schroder
,,	*L.* pumila	*L.-C.* Tydea
,,	*L.* purpurata	*L.-C.* Wellsiana (2)
,,	*L.* xanthina	*L.-C.* Ascania
,,	*L.-C.* Dominiana { *L.* purpurata, *C.* Dowiana aurea }	*L.-C.* Rosalind (1)
,,	*L.-C.* Schilleriana { *L.* purpurata, *C.* intermedia }	*L.-C.* D. S. Brown
,,	,, ,,	*L.-C.* Cybele (1)
velutina	Dowiana aurea	Maronii (1)
,,	*L.* Dayana	*L.-C.* Proserpine
Walkeriana	Mossiæ	Eros
Warneri	Mossiæ	intertexta (1)
,,	*L.* purpurata	*L.-C.* eximia
,,	*L.* tenebrosa	*L.-C.* Gottoiana (1)
,,	*L.-C.* elegans (nat. hyb.)	*L.-C.* Admiral Dewey (1)
Warscewiczii	Aclandiæ	Fernand Denis (1)
,,	bicolor	Ella (1)
,,	Bowringiana	Wendlandii
,,	Dowiana aurea	Hardyana (3)
,,	Gaskelliana	Harold
,,	guttata Leopoldii	Atalanta
,,	Harrisoniana	Ashtonii
,,	Lawrenceana	Jupiter
,,	Loddigesii	Minucia
,,	Schröderæ	H. S. Leon (1)
,,	superba	Euphrasia (1)
,,	*L.* crispa	*L.-C.* Nysa
,,	*L.* Dayana	*L.C.* Euphrosyne
,,	*L.* Perrinii	*L.-C.* Lady Rothschild
,,	*L.* pumila	*L.-C.* Epicasta
,,	*L.* purpurata	*L.-C.* callistoglossa (4)
,,	*L.-C.* amanda (nat. hyb.)	*L.-C.* Brymeriana
,,	*L.-C.* elegans (nat. hyb.)	*L.-C.* Clonia

CHYSIS

bractescens	lævis	chelsoni
„	chelsoni bractescens lævis	langleyensis
chelsoni bractescens lævis	bractescens	langleyensis
lævis	bractecsens	chelsoni

COLAX

jugosus	*Z.* brachypetalum	*Z.-C.* Amesianus (1)
„	*Z.* crinitum	*Z.-C.* Veitchii (1)
„	*Z.* intermedium	*Z.-C.* Wiganianus (1)
„	*Z.* maxillare	*Z.-C.* leopardinus (1)

CYMBIDIUM

eburneum	Lowianum	eburneo-Lowianum
„	„	Lowio-eburneum
„	giganteum	Winnianum
giganteum	eburneum	„
Lowianum	„	eburneo-Lowianum
„	„	Lowio-eburneum

CYPRIPEDIUM

Argus	bellatulum	Madeline
„	Boxalli atratum	Cyris
„	concolor	Evenor
„	Morganiæ superbiens Stonei	Argo-Morganiæ (1)
„	philippinense	Bryan
„	Rothschildianum	Mrs. Rehder
Argus Moensii	insigne Maulei	Swinburnei
Arthurianum insigne Fairieanum	Leeanum insigne Maulei Spicerianum	Mary Lee
„	Spicerianum	Minos
barbatum	bellatulum	Chas. Rickman
„	concolor	tessellatum porphyreum
„	Drurii	Orphanum
„	Fairieanum	vexillarium
„	hirsutissimum	porphyrochlamis Fraseri
„	niveum	Tautzianum
„	philippinense	selligerum
„	superbiens	superciliare
„	villosum	Harrisianum
barbatum Crossii	bellatulum	Chas. Rickman Leysenianum
„ „	Godefroyæ bellatulum niveum	J. Gurney Fowler (1)
„ „	hirsutissimum	porphyrochlamis
„ „	Lowii	calanthum
„ grandiflorum	bellatulum	Chas. Rickman Marchioness of Salisbury
„ „	Spicerianum	Eyermanianum

CYPRIPEDIUM—*continued.*

bellatulum	Argus	Madeline
"	barbatum	Chas. Rickman
"	" Crossii	" Leysenianum
"	" grandiflorum	" Marchioness Salisbury
"	callosum	Wottonii (1)
"	Charlesworthii mosaicum	Dora Crawshaw (1)
"	ciliolare	Olenus (1)
"	concolor	conco-bellatulum
"	Curtisii	Chapmanii (1)
"	Dayanum	Annie Measures
"	enfieldiense	James Buckingham
	{ Hookeræ { Lawrenceanum	
"	Gowerianum magnificum	Mary Beatrice (1)
	{ Lawrenceanum { Curtisii	
"	Harrisianum superbum	Fowlerianum
	{ villosum { barbatum	
"	hirsutissimum	Schofieldianum (1)
"	insigne Chantinii	Helen II. (1)
"	Lawrenceanum	Lawrebel
"	niveum	Godefroyæ (1)
"	philippinense	Phœbe (1)
"	Rothschildianum	Rolfeæ (1)
"	superbiens	Mrs. Fred Hardy
"	superciliare	Arnoldiæ
	{ barbatum { superbiens	
"	Swanianum	William Lloyd
	{ Dayanum { barbatum	
"	vexillarium	bellatulo-vexillarium (1)
	{ barbatum { Fairieanum	
Boissierianum	Schlimii albiflorum	Cleola
"	Sedenii candidulum	Brysa
	{ Schlimii albiflorum { longifolium	
Boxallii	Charles Canham	Captain Lendy
	{ villosum { superbiens	
"	hirsutissimum	Godseffianum
"	Leeanum	Hera (2)
	{ insigne Maulei { Spicerianum	
"	Spicerianum	Calypso
" atratum	Argus	Cyris
" "	Lawrenceanum	Thayerianum
" "	Spicerianum	Calypso, Oakwood var.
callophyllum	œnanthum superbum	Pollettianum
{ barbatum { venustum	{ Harrisianum { { barbatum { { villosum { insigne Maulei	
callosum	bellatulum	Wottonii (1)
"	concolor	conco-callosum (1)
"	Fairieanum	Juno
"	insigne Chantinii	Leoniæ
"	Rothschildianum	calloso-Rothschildianum (1)

CYPRIPEDIUM—*continued.*

callosum	Tautzianum	Nandii
	{ niveum / barbatum }	
„ Sanderæ . . .	Lawrenceanum Hyeanum	Maudiæ (1)
calurum	caudatum Lindeni . .	Penelaus
{ longifolium / Sedenii { Schlimii / longifolium } }		
caricinum	caudatum	Dominianum
caudatum	caricinum	„
„	longifolium	grande
„	Sedenii	Schröderæ
	{ Schlimii / longifolium }	
„ Lindeni . . .	calurum	Penelaus
	{ longifolium / Sedenii { Schlimii / longifolium } }	
„ „ . . .	conchiferum	Clonius
	{ caricinum / Roezlii }	
„ „ . . .	grande	macrochilum giganteum
	{ longifolium / caudatum }	
„ „ . . .	longifolium	macrochilum
„ Wallisii . . .	Sedenii candidulum . .	Schröderæ candidulum
	{ Schlimii albiflorum / longifolium }	
„ Warscewiczii .	conchiferum	nitidissimum
	{ caricinum / Roezlii }	
Chamberlainianum . . .	Haynaldianum	Haynaldo-Chamberlainianum (1)
„ . . .	insigne	Miss L. Fowler (1)
Charles Canham . . .	Boxallii	Captain Lendy
{ villosum / superbiens }		
„ „ . . .	Harrisianum superbum .	Vidor (1)
	{ villosum / barbatum }	
Charlesworthii	Creon	Lord Roberts (1)
	{ Harrisianum superbum { villosum / barbatum } / œnanthum superbum { Harrisianum { villosum / barbatum } / insigne Maulei } }	
„	insigne	Hitchinsiæ (1)
„	Lathamianum	Mrs. Alfred Fowler (1)
	{ Spicerianum / villosum }	
„ mosaicum .	bellatulum	Dora Crawshaw (1)
ciliolare	bellatulum	Olenus (1)
„	niveum	Winifred Hollington
„	„	Aylingii
„	philippinense	Alfred Hollington
„	selligerum	Ashtonii
	{ barbatum / philippinense }	
„	Spicerianum	Bookerii
„	Stonei	Madame G. Truffaut

CYPRIPEDIUM—*continued.*

conchiferum	caudatum Lindeni . .	Clonius
caricinum Roezlli		
„	„ Warscewiczii .	nitidissimum
concolor	Argus	Evenor
„	barbatum	tessellatum porphyreum
„	bellatulum	conco-bellatulum
„	callosum	conco-callosum (1)
„	Curtisii	Minnie Ames
„	Dayanum	Salus (1)
„	Harrisianum	J. H. Berry
	villosum barbatum	
„	insigne	Orion (1)
„	Lawrenceanum	conco-Lawre
„	Spicerianum	Arete
„	Stonei platytænium . .	platy-color
Creon	Charlesworthii	Lord Roberts (1)
Harrisianum superbum villosum barbatum œnanthum superbum Harrisianum villosum barbatum insigne Maulei		
Curtisii	bellatulum	Chapmanii (1)
„	concolor	Minnie Ames
„	Lawrenceanum	Gowerianum
„	niveum	Cowleyanum
„	philippinense	Clinkaberryanum
„	Sanderianum	Sanderiano-Curtisii (1)
„	Spicerianum.	Allanianum
„	Stonei platytænium . .	J. H. Veitch
Dayanum	bellatulum	Annie Measures
„	concolor	Salus (1)
Dominianum	Schlimii	albo-purpureum
caricinum caudatum		
Drurii	barbatum	Orphanum
„	insigne	Æson (1)
„	niveum	microchilum
„	superbiens	T. B. Haywood
„	villosum	Winnianum
enfieldiense	bellatulum	James Buckingham
Hookeræ Lawrenceanum		
Fairieanum	barbatum	vexillarium
„	callosum	Juno
„	insigne	Arthurianum
„	insigne Chantinii . . .	Arthurianum pulchellum
„	Lawrenceanum	Fairieano-Lawrenceanum
„	Leeanum	Regina
	insigne Maulei Spicerianum	
„	œnanthum superbum . .	Baron Schröder (2)
	Harrisianum villosum barbatum insigne Maulei	
„	purpuratum	H. Ballantine
„	Spicerianum	Niobe
„	superbiens	Edwardii

CYPRIPEDIUM—*continued.*

Godefroyæ bellatulum niveum	barbatum Crossii	J. Gurney Fowler (1)
Gowerianum Lawrenceanum Curtisii	Rothschildianum	Shillianum (1)
„ magnificum	bellatulum	Mary Beatrice (1)
grande longifolium caudatum	caudatum Lindeni	macrochilum giganteum
Harrisianum villosum barbatum	concolor	J. H. Berry
„	insigne Maulei	Galatea majus
„	„	œnanthum
„	Lawrenceanum	gigas
„	Rothschildianum	excelsior
„	venustum	Ianthe
„ superbum	bellatulum	Fowlerianum
„ „	Chas. Canham villosum superbiens	Vidor (1)
„ „	Lawrebel Lawrenceanum bellatulum	Unixia (1)
„ „	œnanthum superbum Harrisianum villosum barbatum insigne Maulei	Creon
„ „	Sallieri Hyeanum insigne villosum	Talisman (1)
„ „	Sanderianum	Harri-Sander
„ „	Spicerianum	Osbornei
„ „	„	Pitcherianum
Haynaldianum	Chamberlainianum	Haynaldo-Chamberlainianum (1)
„	Leeanum insigne Maulei Spicerianum	Clothilde Moens
„	philippinense	Lebaudyanum (1)
„	Spicerianum	Carnusianum
hirsutissimum	barbatum	porphyrochlamis Fraseri
„	„ Crossii	porphyrochlamis
„	bellatulum	Schofieldianum (1)
„	Boxallii	Godseffianum
„	Sallieri insigne villosum	hirsuto-Sallieri (1)
„	Spicerianum	Ceres
„	superbiens	Captain Holford (1)
„	Swanianum Dayanum barbatum	T. W. Bond (1)
„	villosum	Germinyanum
Hookeræ	Lawrenceanum	enfieldiense
„	superbiens	Œnone
insigne	Chamberlainianum	Miss L. Fowler (1)
„	Charlesworthii	Hitchinsiæ (1)
„	concolor	Orion (1)
„	Drurii	Æson (1)
„	Fairieanum	Arthurianum
„	niveum	Muriel Hollington

CYPRIPEDIUM—*continued.*

insigne	Smithii	Sir Redvers Buller (1)
	{ Lawrenceanum { ciliolare	
"	villosum	Sallieri aureum
" Chantinii	bellatulum	Helen II. (1)
" "	callosum	Leoniæ
" "	Fairieanum	Arthurianum pulchellum
" "	Niobe	Priam (1)
	{ Spicerianum { Fairieanum	
" "	œnanthum superbum	Milo (1)
	{ Harrisianum { { villosum { { barbatum { insigne Maulei	
Maulei	Argus Moensi	Swinburnei
"	Harrisianum	œnanthum
	{ villosum { barbatum	
" "	"	Galatea majus
" "	Spicerianum	Leeanum (1)
" "	villosum	nitens
" Sanderæ	Leeanum	Actæus langleyense (1)
	{ insigne Maulei { Spicerianum	
" "	Sallieri Hyeanum	Troilus (1)
	{ insigne { villosum	
" "	Spicerianum	Leeanum Prospero majus (1)
Io grande	Rothschildianum	Neptune
{ Argus { Lawrenceanum		
"	Youngianum	Frau Ida Brandt
	{ philippinense { superbiens	
J. Howes	Mrs. Charles Canham	Cobbiæ (1)
{ villosum aureum { Sallieri Hyeanum { { insigne { { villosum	{ superbiens { villosum	
Lathamianum	Charlesworthii	Mrs. Alfred Fowler (1)
{ Spicerianum { villosum		
Lawrebel	Harrisianum superbum	Unixia (1)
{ Lawrenceanum { bellatulum	{ villosum { barbatum	
Lawrenceanum	bellatulum	Lawrebel
"	Boxallii atratum	Thayerianum
"	concolor	conco-Lawre
"	Curtisii	Gowerianum
"	Fairieanum	Fairieano-Lawrenceanum
"	Harrisianum	gigas
	{ villosum { barbatum	
"	Hookeræ	enfieldiense
"	Marshallianum	Henry Graves, junr.
	{ venustum { concolor	
"	nitens magnificum	Johnsonianum
	{ insigne Maulei { villosum	
"	niveum	Antigone
"	"	Aphrodite
"	"	Telemachus

CYPRIPEDIUM—*continued.*

Lawrenceanum	Rothschildianum	Wiertzianum (2)
,,	Spicerianum	radiosum
,,	Stonei	Numa
,,	superbiens	Euryale
Lawrenceanum Hyeanum	callosum Sanderæ	Maudiæ (1)
Leeanum	Arthurianum	Mary Lee
insigne Maulei	insigne	
Spicerianum	Fairieanum	
,,	Boxallii	Hera (2)
,,	Fairieanum	Regina
,,	Haynaldianum	Clothilde Moens
,,	insigne Sanderæ	Actæus langleyense (1)
,,	selligerum	Ashworthiæ
Lindleyanum	Sedenii candidulum	Phædra
	Schlimii albiflorum	
	longifolium	
,,	Sedenii porphyreum	Perseus
	Schlimii	
	longifolium	
longifolium	caudatum	grande
,,	caudatum Lindeni	macrochilum
,,	Schlimii	Sedenii
,,	,, albiflorum	leucorrhodum
,,	Sedenii	calurum
	Schlimii	
	longifolium	
Lowii	barbatum Crossii	calanthum
,,	Sanderianum	Mrs. Reginald Young (1)
,,	Spicerianum	Spicero-Lowii
Marshallianum	Lawrenceanum	Henry Graves, junr.
venustum		
concolor		
Morganiæ	Argus	Argo-Morganiæ (1)
superbiens		
Stonei		
,,	Rothschildianum	I'Ansonii (1)
Mrs. Charles Canham	J. Howes	Cobbiæ (1)
superbiens	villosum aureum	
villosum	Sallieri Hyeanum	
	insigne	
	villosum	
Niobe	insigne Chantinii	Priam (1)
Spicerianum		
Fairieanum		
,,	Spicerianum	Norma
nitens magnificum	Lawrenceanum	Johnsonianum
insigne Maulei		
villosum		
niveum	barbatum	Tautzianum
,,	bellatulum	Godefroyæ (1)
,,	ciliolare	Winifred Hollington
,,	,,	Aylingii
,,	Curtisii	Cowleyanum
,,	Drurii	microchilum
,,	insigne	Muriel Hollington
,,	Lawrenceanum	Antigone
,,	,,	Aphrodite
,,	,,	Telemachus
,,	philippinense	Vipanii
,,	superbiens	The Pard
,,	tonsum	Olivia (1)

CYPRIPEDIUM—*continued.*

œnanthum	superbiens	œno-superbiens
Harrisianum villosum barbatum insigne Maulei		
„ superbum	callophyllum	Pollettianum
	barbatum venustum	
„ „	Fairieanum	Baron Schröder (2)
„ „	Harrisianum superbum	Creon
	villosum barbatum	
„ „	insigne Chantinii	Milo (1)
„ „	Sallieri	triumphans
	insigne villosum	
„ „	Spicerianum	Tityus
philippinense	Argus	Bryan
„	barbatum	selligerum
„	bellatulum	Phœbe (1)
„	ciliolare	Alfred Hollington
„	Curtisii	Clinkaberryanum
„	Haynaldianum	Lebaudyanum (1)
„	niveum	Vipanii
„	superbiens	Youngianum
„	venustum	Arthur
purpuratum	Fairieanum	H. Ballantine
„	Spicerianum	Maynardi
Rothschildianum	Argus	Mrs. Rehder (1)
„	bellatulum	Rolfeæ (1)
„	callosum	calloso-Rothschildianum (1)
„	Gowerianum	Shillianum (1)
	Lawrenceanum Curtisii	
„	Harrisianum	excelsior
	villosum barbatum	
„	Io grande	Neptune
	Argus Lawrenceanum	
„	Lawrenceanum	Wiertzianum (2)
„	Morganiæ	I'Ansonii (1)
	superbiens Stonei	
„	superbiens	W. R. Lee (1)
„	superciliare	Massaianum
	barbatum superbiens	
Sallieri	hirsutissimum	hirsuto-Sallieri (1)
insigne villosum		
„	œnanthum superbum	triumphans
	Harrisianum villosum barbatum insigne Maulei	
„ Hyeanum	Harrisianum superbum	Talisman (1)
	villosum barbatum	
„ „	insigne Sanderæ	Troilus (1)
„ „	Spicerianum	Surprise (1)
„ „	villosum aureum	J. Howes

CYPRIPEDIUM—*continued.*

Sanderianum	Curtisii	Sanderiano-Curtisii (1)
„	Harrisianum superbum .	Harri-Sander
	villosum barbatum	
„	Lowii	Mrs. Reginald Young (1)
„	superbiens	Sandero-superbiens
Schlimii	Dominianum	albo-purpureum
	caricinum caudatum	
„	longifolium	Sedenii
„ albiflorum . .	Boissierianum	Cleola
„ „ . .	longifolium	leucorrhodum
„ „ . .	Sedenii	cardinale
	Schlimii longifolium	
Sedenii	caudatum	Schröderæ
Schlimii longifolium		
„	longifolium	calurum
„	Schlimii albiflorum . .	cardinale
„ candidulum . .	Boissierianum	Brysa
Schlimii albiflorum longifolium		
„ „ . .	caudatum Wallisii . .	Schröderæ candidulum
„ „ . .	Lindleyanum	Phædra
„ porphyreum . .	„	Perseus
Schlimii longifolium		
selligerum	ciliolare	Ashtonii
barbatum philippinense		
„	Leeanum	Ashworthiæ
	insigne Maulei Spicerianum	
„	superbiens	Eleanor
Smithii	insigne	Sir Redvers Buller (1)
Lawrenceanum ciliolare		
Spicerianum	Arthurianum	Minos
	insigne Fairieanum	
„	barbatum grandiflorum .	Eyermanianum
„	Boxallii	Calypso
„	„ atratum . . .	„ Oakwood var.
„	ciliolare	Bookerii
„	concolor	Arete
„	Curtisii	Allanianum
„	Fairieanum	Niobe
„	Harrisianum superbum .	Osbornei
	villosum barbatum	
„	„ „ .	Pitcherianum
„	Haynaldianum	Carnusianum
„	hirsutissimum	Ceres
„	insigne Maulei	Leeanum (1)
„	„ Sanderæ	„ Prosper majus (1)
„	Lawrenceanum	radiosum
„	Lowii	Spicero-Lowii
„	Niobe	Norma
	Spicerianum Faireanum	

CYPRIPEDIUM—*continued.*

Spicerianum	œnanthum superbum	Tityus
	Harrisianum	
	villosum	
	barbatum	
	insigne Maulei	
„	purpuratum	Maynardi
„	Sallieri Hyeanum	Surprise (1)
	insigne	
	villosum	
„	Stonei	Alice
„	superbiens	picturatum
„	tonsum	Madame Jules Hye
„	vexillarium	Statterianum
	barbatum	
	Fairieanum	
„	villosum	Lathamianum
Stonei	ciliolare	Madame G. Truffaut
„	Lawrenceanum	Numa
„	Spicerianum	Alice
„	superbiens	Morganiæ
„	venustum	Doris
„ **platytænium**	concolor	platy-color
„ „	Curtisii	J. H. Veitch
„ „	superbiens	Morganiæ langleyense
superbiens	barbatum	superciliare
„	bellatulum	Mrs. Fred Hardy
„	Drurii	T. B. Haywood
„	Fairieanum	Edwardii
„	hirsutissimum	Captain Holford (1)
„	Hookeræ	Œnone
„	Lawrenceanum	Euryale
„	niveum	The Pard
„	œnanthum	œno-superbiens
	Harrisianum	
	villosum	
	barbatum	
	insigne Maulei	
„	philippinense	Youngianum
„	Rothschildianum	W. R. Lee (1)
„	Sanderianum	Sandero-superbiens
„	selligerum	Eleanor
	barbatum	
	philippinense	
„	Spicerianum	picturatum
„	Stonei	Morganiæ
„	Stonei platytænium	Morganiæ langleyense
superciliare	bellatulum	Arnoldiæ
barbatum		
superbiens		
„	Rothschildianum	Massaianum
Swanianum	bellatulum	William Lloyd
Dayanum		
barbatum		
„	hirsutissimum	T. W. Bond (1)
Tautzianum	callosum	Nandii
niveum		
barbatum		
tonsum	niveum	Olivia (1)
„	Spicerianum	Madame Jules Hye
venustum	Harrisianum	Ianthe
	villosum	
	barbatum	

CYPRIPEDIUM—*continued.*

venustum	philippinense	Arthur
"	Stonei	Doris
vexillarium	bellatulum	bellatulo-vexillarium (1)
{ barbatum { Fairieanum		
"	Spicerianum	Statterianum
villosum	barbatum	Harrisianum
"	Drurii	Winnianum
"	hirsutissimum	Germinyanum
"	insigne	Sallieri aureum
"	insigne Maulei	nitens
"	Spicerianum	Lathamianum
villosum aureum	Sallieri Hyeanum	J. Howes
	{ insigne { villosum	
Youngianum	Io grande	Frau Ida Brandt
{ philippinense { superbiens	{ Argus { Lawrenceanum	

DENDROBIUM

Ainsworthii	Findlayanum	chrysodiscus
{ aureum { nobile		
"	"	melanodiscus
"	moniliforme	Doris
"	nobile	Euryalus (1)
"	signatum	Melpomene (1)
"	Wardianum	Clio (2)
albo-sanguineum	nobile	Murrayi
aureum	euosmum	Cordelia
	{ endocharis { { moniliforme { { aureum { nobile	
"	Findlayanum	Schneiderianum
"	Linawianum	dulce
"	moniliforme	endocharis
"	nobile	Ainsworthii (3)
"	Wardianum	Aspasia (1)
Bensoniæ	crystallinum	Statterianum
"	McCarthiæ	Kenneth
"	moniliforme	Virginia
bigibbum	Linawianum	Sibyl
chrysotoxum	Dalhousieanum	illustre
crassinode	luteolum	Astrea (1)
"	Wardianum	crassinodo-Wardianum
crystallinum	Bensoniæ	Statterianum
Dalhousieanum	chrysotoxum	illustre
"	nobile	Dalhou-nobile (1)
"	superbum	porphyrogastrum
Dominianum	Findlayanum	Burberryanum (1)
{ Linawianum { nobile		
endocharis	nobile	euosmum
{ moniliforme { aureum		

DENDROBIUM—*continued.*

euosmum endocharis moniliforme aureum nobile	aureum	Cordelia
Falconeri	nobile	Venus
Findlayanum	Ainsworthii aureum nobile	chrysodiscus
,,	,,	melanodiscus
,,	aureum	Schneiderianum
,,	Dominianum Linawianum nobile	Burberryanum (1)
,,	nobile	Cybele
formosum	Lowii	formoso-Lowii (1)
Hildebrandii	nobile	Wiganianum (1)
Kingianum	speciosum	specio-Kingianum
Linawianum	aureum	dulce
,,	bigibbum	Sibyl
,,	Wardianum	chlorostele
lituiflorum	,,	micans
Lowii	formosum	formoso-Lowii (1)
luteolum	crassinode	Astrea (1)
,,	Wardianum	Bryan
McCarthiæ	Bensoniæ	Kenneth
moniliforme	Ainsworthii aureum nobile	Doris
,,	aureum	endocharis
,,	Bensoniæ	Virginia
,,	nobile albiflorum	Cassiope
nobile	Ainsworthii aureum nobile	Euryalus (1)
,,	albo-sanguineum	Murrayii
,,	aureum	Ainsworthii (3)
,,	Dalhousieanum	Dalhou-nobile (1)
,,	endocharis moniliforme aureum	euosmum
,,	Falconeri	Venus
,,	Findlayanum	Cybele
,,	Hildebrandii	Wiganianum (1)
,,	Ruckeri	Rœblingianum (1)
,,	signatum	Wiganiæ (1)
,,	tortile	Niobe
,,	Wardianum	Euterpe (1)
,, albiflorum	moniliforme	Cassiope
Parishii	superbum	Nestor (1)
Ruckeri	nobile	Rœblingianum (1)
sanguinolentum	superbum	Rhodostoma (1)
signatum	Ainsworthii aureum nobile	Melpomene (1)
,,	nobile	Wiganiæ (1)
speciosum	Kingianum	specio-Kingianum
superbum	Dalhousieanum	porphyrogastrum
,,	Parishii	Nestor (1)
,,	sanguinolentum	Rhodostoma (1)
tortile	nobile	Niobe

DENDROBIUM—*continued.*

Wardianum	Ainsworthii	Clio (2)
	aureum nobile	
"	aureum	Aspasia (1)
"	crassinode	crassinodo-Wardianum
"	Linawianum	chlorostele
"	lituiflorum	micans
"	luteolum	Bryan
"	nobile	Euterpe (1)

DISA

grandiflora	Veitchii	Diores (2)
	grandiflora racemosa	
"	racemosa	Veitchii
racemosa	grandiflora	"
"	tripetaloides	langleyensis
tripetaloides	racemosa	"
"	Veitchii	Premier
	grandiflora racemosa	
Veitchii	grandiflora	Diores (2)
grandiflora racemosa		
"	tripetaloides	Premier

EPIDENDRUM

ciliare	Wallisii	Wallisio-ciliare (1)
"	*L.* anceps	*E.-L.* Hardyana
elegantulum	Wallisii	Clarissa (2)
Endresio-Wallisii Endresii Wallisii Wallisii		
Endresii	"	Endresio-Wallisii
Endresio-Wallisii	"	elegantulum (2)
Endresii Wallisii		
evectum	radicans	O'Brienianum
O'Brienianum	*C.* Bowringiana	*E.-C.* Mrs. James O'Brien (1)
evectum radicans		
pseudepidendrum	Wallisii	langleyense (1)
radiatum	*C.* Bowringiana	*E.-C.* radiato Bowringiana (1)
radicans	evectum	O'Brienianum
"	xanthinum	dellense
"	*L.* cinnabarina	*E.-L.* Charlesworthii (1)
"	*L.* purpurata	*E.-L.* radico-purpurata (1)
"	*S.* grandiflora	Epiphronitis Veitchii
Wallisii	ciliare	Wallisio-ciliare (1)
"	elegantulum	Clarissa (2)
	Endresio-Wallisii Endresii Wallisii Wallisii	
"	Endresii	Endresio-Wallisii
"	Endresio-Wallisii	elegantulum (2)
	Endresii Wallisii	
"	pseudepidendrum	langleyense (1)
xanthinum	radicans	dellense

LÆLIA

anceps	purpurata	Edissa (1)
,,	*C.* Trianæi	*L.-C.* Frederick Boyle (1)
,,	*E.* ciliare	*E.-L.* Hardyana
autumnalis	purpurata	Omen (1)
cinnabarina	Digbyana	Mrs. M. Gratrix (4)
,,	Pilcheri	flammea
	{ crispa	
	{ Perrinii	
,,	purpurata	Latona
,,	*C.* Aclandiæ	*L.-C.* Adolphus (1)
,,	*C.* Dowiana aurea	*L.-C.* Charlesworthii (1)
,,	*C.* guttata	*L.-C.* Vacuna (1)
,,	*C.* Lawrenceana	*L.-C.* highburiensis
,,	*C.* Mossiæ	*L.-C.* Hippolyta (2)
,,	*C.* Schroderæ	*L.-C.* G. S. Ball (1)
,,	*C.* superba	*L.-C.* Sunray (1)
,,	*C.* Trianæi	*L.-C.* warnhamiensis (2)
,,	*E.* radicans	*E.-L.* Charlesworthii (1)
crispa	Dayana	Euterpe
,,	Perrinii	Pilcheri
,,	purpurata	splendens (1)
,,	xanthina	Olivia (2)
,,	*C.* Dowiana	*L.-C.* Pallas
,,	*C.* Eldorado	*L.-C.* Pisandra
,,	*C.* Gaskelliana	*L.-C.* Bryan (1)
,,	*C.* labiata	*L.-C.* Veitchiana
,,	*C.* Loddigesii	*L.-C.* Tresederiana
,,	*C.* maxima	*L.-C.* Amesiana
,,	*C.* Warscewiczii	*L.-C.* Nysa
,,	*L.-C.* Dominiana	*L.-C.* Victoria
	{ *L.* purpurata	
	{ *C.* Dowiana aurea	
Dayana	crispa	Euterpe
,,	xanthina	Oweniana
,,	*C.* dolosa	*L.-C.* Maynardi
,,	*C.* Dowiana aurea	*L.-C.* Ingramii (1)
,,	*C.* Gaskelliana	*L.-C.* Eunomia
,,	*C.* granulosa Schofieldiana	*L.-C.* Galatea (1)
,,	*C.* labiata	*L.-C.* Wilsoniæ (1)
,,	*C.* Loddigesii	*L.-C.* Aurora
,,	*C.* Lüddemanniana	*L.-C.* Timora
,,	*C.* velutina	*L.-C.* Proserpine
,,	*C.* Warscewiczii	*L.-C.* Euphrosyne
,,	*L.-C.* elegans (nat. hyb.)	*L.-C.* Novelty
,,	*S.* grandiflora	*S.-L.* læta (1)
Digbyana	cinnabarina	Mrs. M. Gratrix (4)
,,	purpurata	Digbyano-purpurata (1)
,,	*C.* Gaskelliana	*L.-C.* Thorntonii (1)
,,	*C.* Mendelii	*L.-C.* Digbyano-Mendelii (3)
,,	*C.* Mossiæ	*L.-C.* Digbyano-Mossiæ
,,	*C.* Trianæi	*L.-C.* Digbyano-Trianæi (1)
,,	*L.-C.* Aphrodite	*L.-C.* Edgar Wigan (1)
	{ *L.* purpurata	
	{ *C.* Mendelii	
flava	*C.* intermedia	*L.-C.* intermedio-flava (1)
,,	*C.* Percivaliana	*L.-C.* Ernestii (1)
,,	*C.* Skinneri	*L.-C.* Marriottiana
,,	*C.* Trianæi	*L.-C.* Myra (1)
,,	*S.* grandiflora	*S.-L.* Marriottiana (1)

LÆLIA—*continued.*

harpophylla	purpurata	Briseis (1)
"	*C.* Trianæi	*L.-C.* Doris
Jongheana	"	*L.-C.* Baroness Schroder
majalis	*C.* Mossiæ	*L.-C.* Juno (1)
Perrinii	crispa	*L.-C.* Pilcheri
"	pumila	juvenilis
"	purpurata	Lucy Ingram (1)
"	*C.* Dowiana aurea	*L.-C.* Decia
"	*C.* Gaskelliana	*L.-C.* Semiramis (1)
"	*C.* labiata	*L.-C.* Statteriana
"	*C.* Luddemanniana	*L.-C.* Hermione (1)
"	*C.* Warscewiczii	*L.-C.* Lady Rothschild
Pilcheri { crispa / Perrinii }	cinnabarina	flammea
pumila	Perrinii	juvenilis
"	*C.* Bowringiana	*L.-C.* Parysatis
"	*C.* Trianæi	*L.-C.* Tydea
"	*C.* Warscewiczii	*L.-C.* Epicasta
"	*L.-C.* exoniensis (nat. hyb.)	*L.-C.* Cassiope (1)
" præstans	*C.* bicolor	*L.-C.* præstans-bicolor (1)
" "	*C.* Dowiana aurea	*L.-C.* Clive
purpurata	anceps	Edissa (1)
"	autumnalis	Omen (1)
"	cinnabarina	Latona
"	crispa	splendens (1)
"	Digbyana	Digbyano-purpurata (1)
"	harpophylla	Briseis (1)
"	Perrinii	Lucy Ingram (1)
"	*C.* Dowiana	*L.-C.* Dominiana (3)
"	*C.* Gaskelliana	*L.-C.* Violetta (1)
"	*C.* intermedia	*L.-C.* Schilleriana (1)
"	*C.* labiata	*L.-C.* bella
"	"	*L.-C.* Wellsiæ
"	*C.* Lawrenceana	*L.-C.* Hyeana (1)
"	*C.* Luddemanniana	*L.-C.* Duvaliana
"	*C.* Mendelii	*L.-C.* Aphrodite (5)
"	*C.* Mossiæ	*L.-C.* Canhamiana (3)
"	*C.* Schroderæ	*L.-C.* Fascinator (1)
"	*C.* Trianæi	*L.-C.* Wellsiana (2)
"	*C.* Warneri	*L.-C.* eximia
"	*C.* Warscewiczii	*L.-C.* callistoglossa (4)
"	*L.-C.* callistoglossa { *L.* purpurata / *C.* Warscewiczii }	*L.-C.* Mrs. Birkbeck (1)
"	*L.-C.* elegans (nat. hyb.)	*L.-C.* dellensis
"	*E.* radicans	*E.-L.* radico-purpurata (1)
" alba	*C.* Gaskelliana	*L.-C.* C. G. Roebling
tenebrosa	*C.* Aclandiæ	*L.-C.* Remula (1)
"	*C.* Dowiana aurea	*L.-C.* luminosa (1)
"	*C.* Hardyana { *C.* Dowiana aurea / *C.* Warscewiczii }	*L.-C.* Haroldiana (2)
"	*C.* labiata flammea	*L.-C.* Lucasiana (1)
"	*C.* Mossiæ	*L.-C.* Martineti (1)
"	*C.* Warneri	*L.-C.* Gottoiana (1)
"	*L.-C.* callistoglossa { *L.* purpurata / *C.* Warscewiczii }	*L.-C.* Ivernia (1)

LÆLIA—*continued.*

tenebrosa	*L.-C.* Schilleriana . . . { *L.* purpurata { *C.* intermedia	*L.-C.* Massangeana (1)
„ Charlesworthii .	*S.* grandiflora	*S.-L.* Gratrixæ (1)
xanthina	crispa	Olivia (2)
„	Dayana	Oweniana
„	*C.* bicolor	*L.-C.* Elstead Gem
„	*C.* Dowiana aurea . . .	*L.-C.* Ophir (1)
„	*C.* Gaskelliana	*L.-C.* The Hon. Mrs. Astor
„	*C.* granulosa Schofieldiana	*L.-C.* Robin Measures (1)
„	*C.* Mendelii	*L.-C.* Zephyra
„	*C.* Trianæi	*L.-C.* Ascania

LÆLIO-CATTLEYA

amanda (nat. hyb.) . . .	*C.* Warscewiczii . . .	Brymeriana
Aphrodite . . . . { *L.* purpurata { *C.* Mendelii	*L.* Digbyana	Edgar Wigan (1)
callistoglossa . . . . . { *L.* purpurata { *C.* Warscewiczii	*L.* purpurata	Mrs. Birkbeck (1)
„	*L.* tenebrosa	Ivernia (1)
Dominiana . . . . . { *L.* purpurata { *C.* Dowiana aurea	*C.* Bowringiana	Ilione (1)
„	*C.* Trianæi	Rosalind (1)
„	*L.* crispa	Victoria
elegans (nat. hyb.) . . .	*C.* Aclandiæ	Philbrickiana
„ „ . . .	*C.* bicolor.	Andreana (1)
„ „ . . .	*C.* Brymeriana (nat. hyb.)	Duke of York
„ „ . . .	*C.* citrina	Seraph
„ „ . . .	*C.* Dowiana	Berthe Fournier (2)
„ „ . . .	*C.* Loddigesii	Behrensiana
„ „ . . .	*C.* Lüddemanniana . .	Mardelii
„ „ . . .	*C.* maxima	Chas. Darwin
„ „ . . .	*C.* superba	Sedenii
„ „ . . .	*C.* Warneri	Admiral Dewey (1)
„ „ . . .	*C.* Warscewiczii . . .	Clonia
„ „ . . .	*L.* Dayana	Novelty
„ „ . . .	*L.* purpurata	dellensis
„ „ . . .	*B.-C.*Lindleyana(nat.hyb.)	*B.-C.-L.* Lindleyano-elegans (1)
„ „ . . .	*S.* grandiflora	*S.-L.-C.* Veitchii
„ Turneri (nat. hyb.)	*C.* Bowringiana . . .	Tiresias (1)
„ „	*C.* intermedia	Cicero
„ „	*C.* Loddigesii	Pytho
„ „	*C.* O'Brieniana (nat. hyb.)	Hérode (1)
„ „	*S.* grandiflora	*S.-L.-C.* Eros (1)
exoniensis (nat. hyb.) . .	*C.* labiata	Fanny Leon (1)
„ „ . .	*C.* Loddigesii	fausta
„ „ . .	*C.* superba	triophthalma
„ „ . .	*L.* pumila	Cassiope (1)
fausta . . . . { *L.-C.* exoniensis { *C.* Loddigesii	*C.* Loddigesii	leucoglossa
Gottoiana . . . . { *L.* tenebrosa { *C.* Warneri	*C.* Mossiæ	Wiganiæ (1)

LÆLIO-CATTLEYA—*continued.*

Schilleriana	*C.* Dowiana	Lucilia (1)
{ *L.* purpurata { *C.* intermedia		
,,	*C.* Hardyana	Henry Greenwood (2)
	{ *C.* Dowiana aurea { *C.* Warscewiczii	
,,	*C.* Trianæi	D. S. Brown
,,	,,	Cybele (1)
,,	*L.* tenebrosa	Massangeana (1)

LYCASTE

cruenta	Skinneri	Imschootiana
plana Measuresiana	,,	Balliæ (1)
Schilleriana	,,	schönbrunniensis
Skinneri	cruenta	Imschootiana
,,	plana Measuresiana	Balliæ (1)
,,	Schilleriana	schönbrunniensis

MASDEVALLIA

amabilis	Veitchiana	chelsoni
Asmodia	,,	Alceste (1)
{ Reichenbachiana { chelsoni { { amabilis { { Veitchiana		
Barloeana	infracta	glaphyrantha
,,	Veitchiana	Parlatoreana
caudata Shuttleworthii	Estradæ	caudato-Estradæ
,, ,,	Harryana	Shuttryana (1)
,, ,,	ignea	Henrietta
,, ,,	rosea	Courtauldiana
,, ,,	Veitchiana	Kimballiana
,, ,,	,,	Pourbaixii (1)
,, ,,	xanthina	Gelengiana
chelsoni	Peristeria	Ajax
{ amabilis { Veitchiana		
,,	Reichenbachiana	Asmodia
cucullata	Veitchiana	Bocking hyb. (1)
Davisii	,,	Gairiana
Estradæ	caudata Shuttleworthii	caudato-Estradæ
Harryana	,, ,,	Shuttryana (1)
,,	ignea	Ellisiana
,,	,,	Fraseri
,,	triangularis	Cassiope
,, Lindeni	Veitchiana	falcata (1)
ignea	caudata Shuttleworthii	Henrietta
,,	Harryana	Ellisiana
,,	,,	Fraseri
,,	racemosa	Rushtonii (1)
,, aurantiaca	Veitchiana	Mundyana
infracta	Barloeana	glaphyrantha
macrura	tovarensis	Curlei (1)

MASDEVALLIA—*continued.*

Peristeria	chelsoni	Ajax
	{ amabilis	
	{ Veitchiana	
racemosa	ignea	Rushtonii (1)
Reichenbachiana	chelsoni	Asmodia
	{ amabilis	
	{ Veitchiana	
rosea	caudata Shuttleworthii	Courtauldiana
Schlimii	Veitchiana	Imogen (1)
tovarensis	macrura	Curlei (1)
„	Veitchiana	McVittiæ
triangularis	Harryana	Cassiope
Veitchiana	amabilis	chelsoni
„	Asmodia	Alceste (1)
	{ Reichenbachiana	
	{ chelsoni	
	{ { amabilis	
	{ { Veitchiana	
„	Barloeana	Parlatoreana
„	caudata Shuttleworthii	Kimballiana
„	„ „	Pourbaixii (1)
„	cucullata	Bocking hyb. (1)
„	Davisii	Gairiana
„	Harryana Lindeni	falcata (1)
„	ignea aurantiaca	Mundyana
„	Schlimii	Imogen (1)
„	tovarensis	McVittiæ
xanthina	caudata Shuttleworthii	Gelengiana

MILTONIA

Roezlii	vexillaria	Bleuana (1)
vexillaria	Roezlii	„ (1)

ODONTOGLOSSUM

crispum	Hallii	Hallio-crispum
„	Harryanum	crispo-Harryanum (2)
„	„	Harryano-crispum (1)
„	luteo-purpureum	Wilckeanum (6)
„	triumphans	loochristiense (7)
Hallii	crispum	Hallio-crispum
„	Harryanum	Crawshayanum (1)
Harryanum	crispum	Harryano-crispum (1)
„	„	crispo-Harryanum (2)
„	Hallii	Crawshayanum (1)
„	Lindleyanum	Wattianum
„	luteo-purpureum	Souvenir de Victor Hye de Crom (1)
„	Pescatorei	Rolfeæ (4)
Lindleyanum	Harryanum	Wattianum
luteo-purpureum	crispum	Wilckeanum (6)
„	Harryanum	Souvenir de Victor Hye de Crom (1)
Pescatorei	„	Rolfeæ (4)
„	triumphans	excellens (6)
triumphans	crispum	loochristiense (7)
„	Pescatorei	excellens (6)

PHAIUS

Blumei	tuberculosus	Marthæ
Cooksonii	Humblotii	oakwoodiensis (1)
{ Wallichii tuberculosus		
grandifolius	maculatus	maculato-grandifolius
„	tuberculosus	amabilis
„	*Cal.* Bryan	*P.-C.* grandis (1)
	{ vestita rubro-oculata Williamsii	
„	*Cal.* gigas	*P.-C.* Niobe (1)
	{ Sanderiana vestita rubro-oculata gigantea	
„	*Cal.* Regnierii	*P.-C.* Arnoldiæ
„	*Cal.* vestita rubro-oculata	*P.-C.* irrorata purpurea
„	*Cal.* vestita Turneri nivalis	*P.-C.* irrorata
„	*Cal.* Veitchii	*P.-C.* Sedeniana
	{ vestita rosea	
Humblotii	Cooksonii	oakwoodiensis (1)
	{ Wallichii tuberculosus	
„	Oweniæ	Owenianus
„	Sanderianus	Phœbe (1)
maculatus	grandifolius	maculato-grandifolius
„	Mannii	Ashworthianus (1)
Mannii	maculatus	„ (1)
Oweniæ	Humblotii	Owenianus
Sanderianus	„	Phœbe (1)
„	tuberculosus	Norman (8)
tuberculosus	Blumei	Marthæ
„	grandifolius	amabilis
„	Sanderianus	Norman (8)
„	Wallichii	Cooksonii
Wallichii	tuberculosus	„
„	*Cal.* Baron Schröder	*P.-C.* Schröderiana (1)
	{ Regnierii vestita rubro-oculata gigantea	

PHALÆNOPSIS

amabilis Bl.	intermedia	F. L. Ames
	{ Aphrodite rosea	
„ „	Lüddemanniana	John Seden
„ „	rosea	Artemis
„ „	violacea	Harriettæ
Aphrodite	rosea	intermedia (1)
„	„ leucaspis	Vesta
intermedia	amabilis Bl.	F. L. Ames
{ Aphrodite rosea		
„ Brymeriana	Sanderiana	Lady Rothschild (1)
„ Portei	leucorrhoda (nat. hyb.)	Schröderæ (1)
leucorrhoda (nat. hyb.)	intermedia Portei	„ (1)
	{ Aphrodite rosea	
Lüddemanniana	amabilis Bl.	John Seden

PHALÆNOPSIS—*continued.*

Lüddemanniana	Sanderiana	Mrs. J. H. Veitch (1)
,, ...	Stuartiana	Hermione (1)
,, ...	violacea	Lüdde-violacea
Mannii	Stuartiana	Stuartiano-Mannii (1)
rosea	amabilis Bl.	Artemis
,, ...	Aphrodite	intermedia (1)
,, ...	Sanderiana	Hebe (1)
,, ...	Stuartiana	Cassandra (1)
,, leucaspis . . .	Aphrodite	Vesta
Sanderiana	intermedia Brymeriana .	Lady Rothschild (1)
	{ Aphrodite { rosea	
,, ...	Lüddemanniana . . .	Mrs. J. H. Veitch (1)
,, ...	rosea	Hebe (1)
Schilleriana	Stuartiana	Schilleriano-Stuartiana (1)
Stuartiana	Lüddemanniana . . .	Hermione (1)
,, ...	Mannii	Stuartiano-Mannii (1)
,, ...	rosea	Cassandra (1)
,, ...	Schilleriana	Schilleriano-Stuartiana (1)
violacea	amabilis Bl.	Harriettæ
,, ...	Lüddemanniana . . .	Lüdde-violacea

SOBRALIA

macrantha	xantholeuca	Veitchii (1)
xantholeuca	macrantha	,, (1)

SOPHRONITIS

grandiflora	*C.* Aclandiæ	*S.-C.* George Hardy (2)
,, ...	*C.* Bowringiana . . .	*S.-C.* eximia
,, ...	*C.* calummata	*S.-C.* Nydia (1)
	{ intermedia { Aclandiæ	
,, ...	*C.* guttata Leopoldii . .	*S.-C.* Cleopatra (1)
,, ...	*C.* Harrisoniana . . .	*S.-C.* Chamberlainiana (1)
,, ...	*C.* intermedia	*S.-C.* Batemaniana
,, ...	*C.* Loddigesii	*S.-C.* Calypso
,, ...	*C.* Mossiæ	*S.-C.* Queen Empress (1)
,, ...	*L.* Dayana	*S.-L.* læta (1)
,, ...	*L.* flava	*S.-L.* Marriottiana (1)
,, ...	*L.* tenebrosa Charlesworthii	*S.-L.* Gratrixæ (1)
,, ...	*L.-C.* elegans (nat. hyb.)	*S.-L.-C.* Veitchii
,, ...	*L.-C.* elegans Turneri (nat. hyb.)	*S.-L.-C.* Eros (1)
,, ...	*E.* radicans	*Epiphronitis* Veitchii

SPATHOGLOTTIS

aurea	Vieillardii	aureo-Vieillardii (1)
Vieillardii	aurea	,,

THUNIA

Bensoniæ	Marshalliæ	Veitchiana
Marshalliæ	Bensoniæ	„

VANDA

Hookeriana	teres	Miss Joaquim (1)
teres	Hookeriana	„ (1)

ZYGOPETALUM

brachypetalum	*Col.* jugosus	*Z.-C.* Amesianus (1)
Burkii	Mackaii	leucochilum
crinitum	maxillare	crinito-maxillare
„	*Col.* jugosus	*Z.-C.* Veitchii (1)
intermedium	maxillare Gautieri	Perrenoudii (1)
„	*Col.* jugosus	*Z.-C.* Wiganianus (1)
Mackaii	Burkii	leucochilum
„	maxillare	Sedenii
maxillare	crinitum	crinito-maxillare
„	Mackaii	Sedenii
„	*Col.* jugosus	*Z.-C.* leopardinus (1)
„ Gautieri	intermedium	Perrenoudii (1)

PLANT DISEASES.

[*A Résumé of Six Lectures delivered to the Students in the Society's Gardens at Chiswick.*]

By GEORGE MASSEE, F.L.S.

I.—GENERAL CONSIDERATIONS RESPECTING PLANT DISEASES.

MOST, perhaps all, gardeners and farmers recognise the existence of plant diseases in some form or another. This is more especially true of the injuries caused by insects, due partly to the fact that the work of destruction can in many instances be observed in actual progress; and, furthermore, the existence of insects in their various phases of develop-

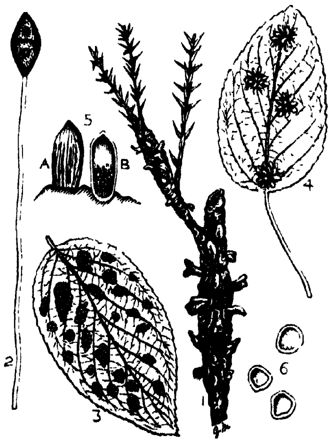

FIG. 303.—PEAR-LEAF CLUSTER-CUP (*Gymnosporangium sabinæ*).

A fungus growing on two different kinds of plant at different periods of its life-cycle. 1. The spring stage of the fungus on a living Juniper branch, reduced in size. 2. Spore of same, × 300. 3–4. 'Cluster-cup,' or summer form of fungus fruit on living Pear-leaves, reduced in size. 5. Two 'cluster-cups,' one cut open, slightly ×. 6. Spores of cluster-cup condition, × 300.

ment is perfectly familiar to most people living in the country, from practical experience in more or less successfully combating the persistent attacks of "blow-flies," Cabbage and Gooseberry caterpillars, Turnip flies, &c.

Now with the majority of destructive fungi the case is very different. Attempting to convince people, who accept as an inviolable rule the old adage that "seeing is believing," that a fungus so minute as to be quite invisible to the naked eye is capable of doing as much injury to plants as the codlin moth or the Cabbage butterfly, creatures of quite respectable dimensions, is asking too much.

Again, the entire life-history or mode of life of most fungi is so very different from that of any of the plants with which the gardener or the

farmer has to deal that the significant shake of the head, implying incredulity, on the part of anyone told for the first time that a fungus may occur under forms as different in appearance from each other as an Oak-tree, a Poppy, and a Water-Lily respectively, during different periods of its complete life-cycle, or that it spends part of its life as a parasite on one particular kind of plant, and then moves to another plant, not in any way related to the one it previously lived upon, to complete its career, is, to say the least, quite pardonable, and furthermore displays the right spirit in not accepting such a strange doctrine without some more convincing proof of its verity than the mere statement, granting that prejudice does not harden the heart and close the mind against accepting absolute proof when tendered.

The above illustrations, along with many other facts equally strange-sounding when heard for the first time, add considerably to the ordinary difficulties experienced in grasping the broad principles of a subject entirely novel; and I hope to be pardoned for stating my experience that the majority of practical men have reached such a high pitch of perfection, in successfully carrying out those branches of their profession which they have thoroughly grasped, that there is more than an indication of the feeling that what they do not already know is not worth consideration.

This feeling is at the present day fast disappearing, however, and there is a manifest desire on the part of most of the rising generation to accept the inevitable, and gain more than a simple rule-of-thumb knowledge respecting the diseases to which plants are subject.

There is a deep-rooted opinion that cultivated plants are more susceptible to disease than wild plants are, and certain appearances seem at first sight to support this view. There is, however, no scientific support for this idea, and most of the apparent evidence may be traced to the fact that many parasitic fungi confine their attacks to one particular kind of plant, or to plants closely allied; hence, for instance, in the case of a large house *crowded* with Tomato plants, if a single plant, to commence with, is attacked by *Cladosporium fulvum*, the disease will gradually spread from this one plant until every plant in the house is diseased, unless prompt measures are taken to prevent the spread of the fungus. Now in this instance, if the plants are well grown, there is no special predisposition to disease proved by the fact that all the plants are attacked; it simply means that the fungus found a lot of plants of the particular kind it could feed upon, huddled together so that it became an easy matter to pass from one to another. Epidemics or wholesale destruction caused by fungi never occur in houses or elsewhere where the plants are of many different kinds.

It may be argued, and with reason, that crops, or assemblages of one particular kind of plant, must of necessity be grown over more or less extensive areas; nevertheless, the fact remains that this massing together of numbers of the same kind of plant is responsible for practically all fungous diseases that occur on a large scale.

Admitting the fact that plants of the same kind must be grown together in large numbers, what the gardener can do is to use proper precautions to prevent the spread of a given disease the moment it

appears; or, better still, to anticipate the presence of such diseases as are known to attack particular kinds of plants under cultivation. This is not always done. Drooping or obviously unhealthy plants are not removed as promptly as they should be, and spraying to prevent the spread of a disease is not sufficiently resorted to.

I have said that cultivated plants well grown are not more susceptible to disease than wild plants are, but when not well grown such plants are rendered liable to attack, and consequently suffer when healthy plants would be able to resist successfully any attack made by the same fungus. "Soft" foliage invites disease, and should always be guarded against as much as possible; unhealthy root-action, resulting from either too much or too little water, too strong solutions of manure, or absence of oxygen in the soil, also places the leaves at the mercy of numerous destructive fungi that can only enter the tissues of the leaf when the general health of the plant is below par. A proper amount of ventilation is indispensable, and too much moisture in the atmosphere should be guarded against, as it is very important to remember that fungus spores can only germinate on the surface of a leaf and enter its tissues when the surface of the leaf is damp. No fungus spore can germinate on a dry surface; therefore, when danger from a fungus epidemic is threatening, it is well to keep the atmosphere as dry as conditions will allow.

As usual, I am quite well aware it will be argued that plants must be watered, and that houses must be damped down, &c. Exactly so, but use moderation. Perhaps it is no exaggeration to say that in many instances about twice as much water is used as is necessary.

I exclude, as being outside the subject of my remarks, those cases where plants are grown at high pressure and with only one object in view —a crop. This is pure speculation, a kind of horticultural gambling, where all laws and rules are set aside. Sometimes the experiment is satisfactory, often not so, as would be expected under such artificial conditions.

Finally, it must be remembered that successful plant cultivation depends to a large extent on the presence of various kinds of bacteria in the soil. It is well known that excessive application of artificial manures of various kinds destroys these indispensable organisms, and although an ephemeral improvement may be observed in the condition of plants so treated, due to the direct action of the manure, the after results are worse than before its application, owing to the disappearance of the bacteria.

II.—Some Reasons why Practical Men are not Successful in Treating Plant Diseases.

From amongst the many reasons that could be enumerated as accounting for lack of success in combating fungus foes, the following are of primary importance, and at the risk of being somewhat tedious must be treated in detail.

(1) The apparent mystery, and absence of anything obvious to account for the presence of certain diseases said to be of fungus origin, is due, as

already stated, to a lack of knowledge of the life-history of fungi, and consequent inability to check the disease, or even to prevent its commencement; whereas the possession of this knowledge would, in many instances, render such a course possible.

By the uninitiated the appearance of a fungus bursting through the tissues of a leaf, stem, or fruit is quite naturally considered as the earliest appearance of the disease; and this idea is strengthened by the fact that in the majority of instances, up to the moment of this rupturing of the tissues and the appearance of the fungus on the surface, the plant appeared to be in perfect health.

Now the above line of reasoning, in spite of appearances in its favour, is radically wrong from beginning to end.

The usual course followed by a parasitic fungus is illustrated by the following examples.

The flowers of *Scilla bifolia* and *Chionodoxa Lucillea* are often disfigured by the presence of a mass of black powder produced in the anthers. This powder consists of the spores of a minute parasitic fungus, and when quite ripe is scattered over the entire flower, completely destroying its beauty.

The appearance of this sooty mass in the flower is considered by the gardener as the first indication of the fungus in the plant. For a long time it was supposed, even by scientific men, that the anthers were infected directly by fungus spores floating in the air. Now that the life-history of the fungus is known, its mode of attack is found to be very different from what was expected. The anthers are not directly infected by the fungus spores, but what happens is as follows. The ripe spores produced in the anthers are carried into the soil by rain, where they germinate, and if the mycelium of the fungus happens to come in contact with a very young seedling *Scilla*, it enters the stem, and continues to grow in the tiny bulb of the young plant. It is important to remember that the *Scilla* or *Chionodoxa* can only be infected by the fungus while it is quite young. When it is a month old all danger is past. When the *Scilla* is old enough to bloom, the mycelium of the fungus present in the bulb, grows up along with the flowering stem, passes into the anthers, and in due course produces a sooty mass of spores ready to infect other seedlings. Year after year, when a plant is once infected, the mycelium of the fungus, living in the bulb, passes up into the flower to form its spores; yet the plant is not killed by the fungus present in its tissues, and there is no outward indication of the parasite during the growth of the plant.

The anthers of many other plants are also attacked by "smut" or fungi belonging to the genus *Ustilago*. In all such that have been examined, the mycelium of the fungus is found to be perennial in the root of the plant, and in all cases the plant can only be inoculated while in the earliest seedling state. Many kinds of caryophyllaceous plants, Carnations, Pinks, *Silene*, *Lychnis*, &c., are subject to this disease.

The life-history of the fungus forming "smut" in the grain of Oats is similar to the above; the plant can only be infected in the seedling stage, the fungus growing along with the stem, and not betraying its presence until the spores form a black sooty powder in the grain. (Fig. 304.)

The above account illustrates the value of strict scientific investigation, which indicates the practical measures to be taken to prevent this particular form of fungus disease. It shows that spraying is of no service; on the other hand, it shows that if the seedlings can be kept free from the fungus for the first month of their existence, all danger of infection

FIG. 304.—OAT SMUT (*Ustilago avenæ*).

This fungus can only enter the tissues of the Oat plant when the latter is very young. The fungus grows along with the Oat plant without betraying its presence until the grain is formed, when a sooty black mass of spores is produced

is past. This can easily be done by sowing the seed in soil free from fungus spores. It further shows that a plant once infected remains so through life; hence the gardener removes all such infected *Scillas*, &c.

The same fact, that infection has taken place some time before the fungus appears as a disease on the surface of the plant, holds good in every instance. It is the province of the specialist to determine the

particular way in which such infection occurs, and the duty of the gardener to become acquainted with such discoveries to the extent necessary for practically combating the infection.

(2) If I have succeeded in demonstrating the presence of fungus mycelium in the tissues of plants under conditions where it would not be suspected by the gardener, it follows that a disease may be, is in fact, often propagated unconsciously. For example, if a Pink showing smut in the anthers is used for "layering," remembering that the mycelium passes up from the root through the stem to the flower, the probability is that every plant produced will be diseased. It is well to avoid using, for vegetative modes of reproduction, portions of any plant showing an

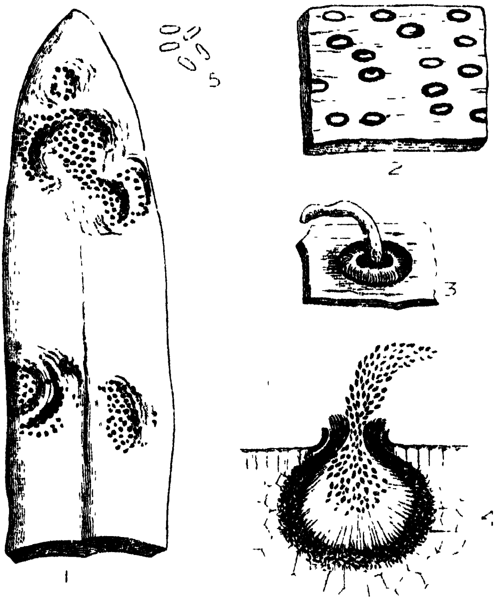

FIG. 305.—ORCHID LEAF-RUST (*Glæosporium cinctum*).

The mycelium is present in the leaf for some time before it appears in a fruiting condition on the surface, as shown in fig. 1. 2. Pustules of fungus, slightly ×. 3. Conidia of fungus oozing out of the leaf in a tendril. 4. Section through a fungus fruit imbedded in the leaf. 5. Conidia of fungus, × 400.

outbreak of fungus fruit on its surface, as in many instances the mycelium extends far beyond the point where it bursts through the tissues, and portions of the plant that might be considered sound may in reality contain mycelium, and if so diseased plants would result.

(3) Lack of cleanliness in matters of detail, as to dealing with fragments of diseased plants. It is sometimes felt that a dead plant can do no harm; this, however, is not the case if the plant has been killed by a fungus. In such instances spores are undoubtedly present, and do not die when the host-plant dies, but are dispersed by wind and lodge in nooks and crevices, and at the proper time commence to germinate and renew the trouble. Burn all fungus-diseased plants as soon as they are realised to be useless, and do not leave them in some corner indefinitely.

III.—Some Fungus Diseases of Herbaceous Plants.

The fungus diseases of herbaceous plants are many, hence but few of the most important can be dealt with in the course of an hour's talk.

Various kinds of the mould known as *Botrytis*, or possibly one kind only, capable of assuming different appearances on different host-plants, first claims attention. This pest has already been dealt with in the Journal of this Society (xxvi. 41, 1901) as affecting Snowdrops; but in addition to this one host, practically every herbaceous plant, also many woody plants, are attacked. To the naked eye this mould appears as a dense olive-brown velvety nap, and when examined under a magnifying-glass, such as all gardeners should carry, the heads of crowded spores can be easily seen.

There are at least two reasons why this fungus is so generally distributed, being practically everywhere, and being capable of attacking almost every kind of plant. (1) It can grow with equal vigour on decaying vegetable matter or on living plants, consequently, wherever the myriads of spores happen to alight, they are almost certain to find some substance upon which they can grow. Those rubbish-heaps consisting of plants in all stages of decay, that are too frequently met with, even in what are considered as well-kept gardens, are simply a paradise for our *Botrytis*, where it can luxuriate in profusion and produce a sufficient number ot spores to infect all the plants growing in the neighbourhood. (2) The germ-tubes, or first threads produced by the germinating spores, contain an enzyme, or ferment, capable of dissolving the cell-walls of living plants, thus enabling the mycelium to gain an entrance into the tissues of its victim.

In addition to spores, *Botrytis* possesses a second method of reproduction. After the fungus has reached the stage of forming spores its mycelium forms numerous small solid lumps, at first white, finally blackish externally. These bodies, called sclerotia, are more or less imbedded in the dying or dead tissues of the host-plant. If a few of these sclerotia are placed in sand and kept moist, after some months of rest the surface of each sclerotium will become covered with a dense felt of *Botrytis* mould, producing myriads of spores. In nature these sclerotia lie on the ground when the plant on which they were formed decays, and on the return of spring give origin to a crop of spores. Every now and again a whole row of Scarlet-runners, or a plot of Broad Beans, Potatos, or other cultivated plants, show indications of something going wrong; the leaves turn yellow, the stems droop, and finally die at an early period, and the crop is a failure. If such plants are carefully examined when the leaves are becoming yellow, tufts of *Botrytis* mould will be found on the stem, near the base more especially. It is too late, even now, to save the crop. If dead stems of the same are split open, numerous black sclerotia, varying in size up to two lines long, will be found imbedded in the central substance of the dead stem.

Through lack of knowledge, the gardener would probably consider the occurrence of such a disease as a mystery that could not be accounted for.

In the event of such an epidemic, probably one of the following two

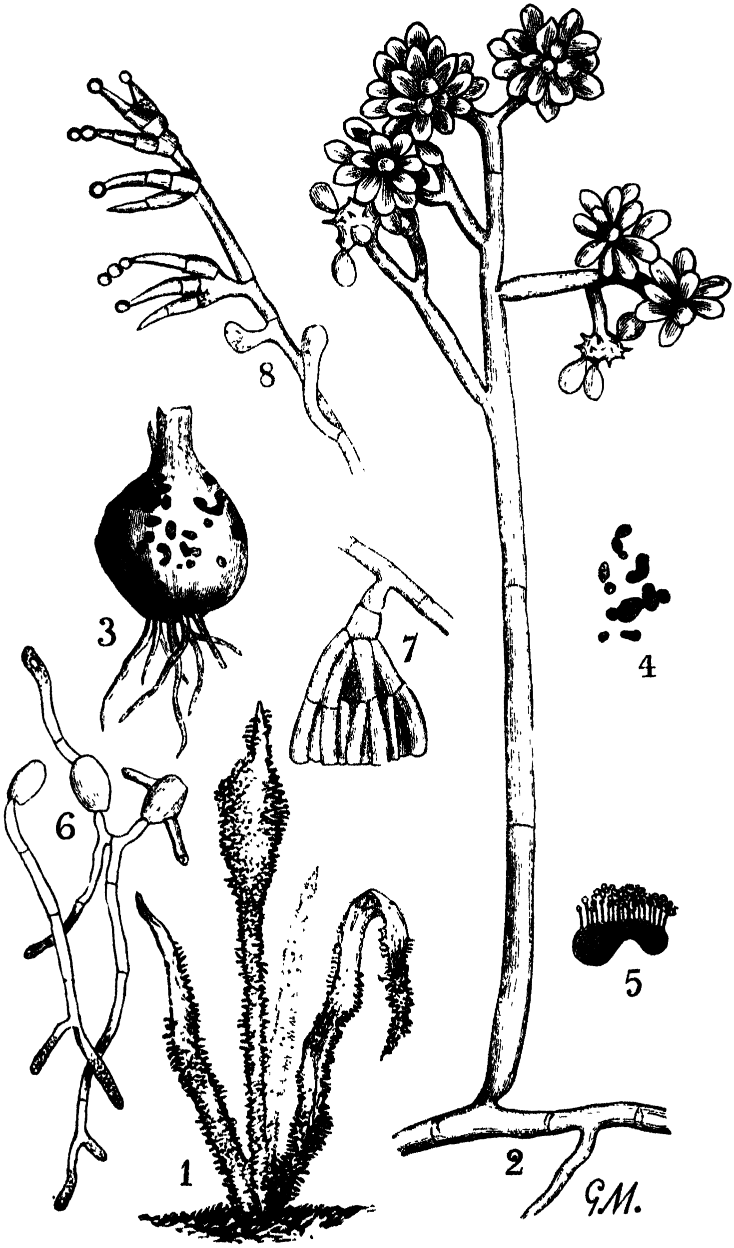

FIG. 306.—BOTRYTIS CINEREA, A PARASITE ON SNOWDROPS.

1. A young Snowdrop badly diseased, nat. size. 2. Fruiting branch of the *Botrytis*, or summer form of the fungus, × 350. 3. A Snowdrop bulb with sclerotia, nat. size. 4. Isolated sclerotia, nat. size. 5. A sclerotium bearing a crop of *Botrytis*, the spring following its formation, × 10. 6. *Botrytis* conidia germinating, × 400. 7. An organ of attachment of the *Botrytis*, × 400. 8. Chains of conidia of unknown use, formed on mycelium of the *Botrytis*, × 400.

things would happen :—(1) A very slovenly person would allow the dead stems to lie on the ground, when, as already stated, the sclerotia would remain until the following season, and then produce a crop of spores, and the disease would appear again in due course. (2) The tidy man would collect all the dead stems, and either deposit them in the piggery or directly on a manure heap, a proceeding, from the point of view of infecting a future crop, not more satisfactory than the previous method, inasmuch as most of the sclerotia would find their way back to the land along with the manure.

FIG. 307.—TOMATO LEAF-RUST (*Cladosporium fulvum*).
Forms brownish velvety patches on the leaves, as in fig. 1. 2. Fruiting branches of the fungus, × 400. 3. Spores of the fungus germinating, × 400.

The only safe method of dealing with material infected with sclerotia is to burn it.

Many other kinds of fungi besides *Botrytis* form sclerotia.

What has been stated respecting the origin of disease from the presence of sclerotia, unconsciously placed in the soil along with manure, holds good for the many fungi that form winter-spores or resting-spores, which remain in an unchanged condition throughout the winter and germinate the following spring. Such spores often remain firmly fixed to the host-plant they grew upon, not being destroyed by the conversion of the material into manure, and in some instances will pass through the

alimentary canal of an animal without being injured. The ultimate fate of such spores is to be carried back to the land in manure.

It may be argued, and with reason, that it is impossible to burn everything bearing spores. This is true, but I consider it my duty, nevertheless, to indicate clearly one of the most frequent sources of fungus diseases. It remains with the practical man, armed with this knowledge, to devise some means of meeting the difficulty.

Even this problem can to a great extent be solved, and an epidemic prevented, by adding a sprinkling of kainit to the manure each time it is moved. Kainit is in itself a good manure. It will not kill either sclerotia or resting-spores, but when these bodies commence to germinate it will kill every germ-tube, also other mycelium present in the manure, that it comes in contact with. Various other fungicides do the same.

Tomato diseases have of late years been much in evidence. One of these, the "sleepy disease," has already been dealt with in this Journal (Vol. xix. p. 20). Two others, Tomato leaf-rust (*Cladosporium fulvum*) and Tomato black-rot or black-stripe (*Macrosporium tomato*), are very destructive. The former attacks the foliage, and in severe cases the young fruit also. It appears under the form of a very short pile or felt of a reddish brown colour, and consists of a miniature forest of innumerable branched threads, each bearing several spores at or near the tip. These spores become free when ripe, and are diffused by wind, or very frequently by syringing before their presence is detected. Each spore alighting on a damp Tomato leaf is capable of producing a new disease centre, and after the pest has once gained a foothold only the most persistent measures can check its spread. This is a case for spraying, the object and methods for the proper conduct of which will be explained later. Pale yellow spots on the upper surface of the leaf are the earliest indication of the presence of this fungus, and when it bursts through to the surface of the leaf to shed its spores it is sufficiently conspicuous to attract attention. Neglect in removing diseased leaves, or entire plants where the evidence of its presence is undoubted, will result in disaster.

Black-rot can also be successfully combated by prompt and constant removal of diseased portions at the earliest moment of appearance, aided by spraying.

IV.—Diseases of Fruit and other Trees.

The fungi attacking living trees may be, as a matter of convenience, divided into two groups: the large, woody, and often perennial forms, including *Polyporus*, &c., growing on the root or trunk; and the small, mostly microscopic kinds, met with on young shoots, leaves, and fruit.

All the larger forms agree in being what are termed wound-parasites, which means that when the spores germinate the germ-tubes cannot directly penetrate an unbroken surface of the tree, but can only gain an entrance through some wound or broken surface. Hence the importance of carefully protecting all cut surfaces with a coat of tar immediately after pruning; branches broken by wind should also be removed, and holes made by woodpeckers, &c., filled up. The *Polyporus* most

destructive to fruit-trees in this country is *P. hirsutus*, which grows out from the trunk like an inverted bracket, measuring from five to eight inches across. The upper surface is brownish and coarsely hairy, the under surface dingy greenish yellow, full of very minute holes or pores containing the spores. The entire substance is rather soft and spongy, and contains a quantity of water, which frequently drips from the lower surface.

A second kind, *Polyporus fomentarius*, also occurs on fruit-trees, but is most abundant on Beech trunks. It somewhat resembles a horse's hoof in shape, upper surface smooth, dark brown, and hard; under side flattish, pale, and pierced with very minute holes containing the brown spores, which are produced in enormous numbers, and fall on the trunk

FIG. 308.—POLYPORUS FOMENTARIUS.
A fungus destructive to various timber and fruit trees.

and surrounding bodies in a mass resembling snuff. These spores are scattered by wind, and in turn infect other trees.

Several other kinds of *Polyporus* and allied forms attack living trees, and all agree in being wound-parasites.

All such fungi should be cut away and the wound protected by a coating of gas-tar. It is all-important that the fungi removed should be burned, and not left lying about to shed their spores, as it is only by means of spores carried by wind or other agents that healthy trees can be infected.

One of our commonest toadstools—*Armillaria mellea*—is very destructive to trees, and illustrates a peculiar mode of attack, exercised also by other destructive parasites. *A. mellea* grows in dense clusters at the base of trunks; the cap is 2–3 inches across, brownish yellow, with

small dark scales; stem 4–6 inches long, yellowish, and with a distinct ring or ruffle surrounding it near the gills. So far as reproduction by spores is concerned, this fungus is a wound-parasite. In gardens and pleasure-grounds the necessary wounds are too frequently due to careless management of the grass-cutting machine. Such wounding should be avoided as much as possible, and when done should be protected with gas-tar. In woods and pastures, wounds at the base of the trunk or on exposed roots are made by rabbits, hares, mice, &c. When the mycelium has once gained an entrance into the root or base of the trunk, it forms a compact white membrane of interwoven mycelium, which extends between the bark and the wood, thus killing the cambium. The disease passes from one root to another and also ascends the trunk. Eventually

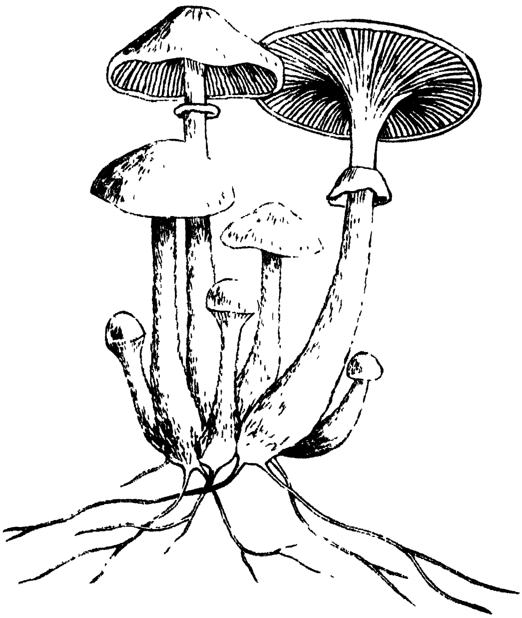

FIG. 309.—TREE-ROOT ROT (*Agaricus melleus*).

A cluster of the fungus showing the cord-like rhizomorphs, which travel underground and attack the roots of living trees of various kinds; one quarter natural size.

the white mycelium gives origin to numerous blackish cord-like strands called rhizomorphs, which grow upwards between the wood and the bark, finally killing the tree. These stout black interwoven strands or rhizomorphs, so frequently present between the wood and the bark of decayed fallen trees, must be familiar to everyone. They signify that the tree was killed by *Armillaria mellea*.

Numerous black rhizomorphs are also formed in the ground round the base of a diseased tree; these spread in the soil in all directions, feeding on the humus present, and increasing without limit in length, but not penetrating more than a few inches below the surface. If a rhizomorph, during its progress through the soil, happens to come in contact with the living root of a tree it is capable of attacking, it enters the root, and thus

forms a new centre of disease, from which the toadstools eventually grow, and a fresh crop of rhizomorphs extend in search of more victims.

There are two methods of preventing the extension of this and other similar pests.

Whenever the toadstools appear round the base of a trunk, they should be collected and burned, or eaten, being included among edible fungi. It is of no use kicking the fungus over and trampling on it; by this means the spores are only dispersed, not destroyed.

It is important to remember that the rhizomorphs of *A. melleus* traversing the soil only increase in length by growth at the extreme tip, and to do this the tip must be constantly surrounded by material available for food. To prevent the extension of these rhizomorphs from a diseased tree, dig a trench, six or eight inches deep and six inches wide, round the trunk and some distance away from it, and fill it with ashes, lime, or any substance devoid of humus. Through this barrier the rhizomorphs cannot extend, owing to lack of food.

The majority of those white mildews so destructive to the Hop, Rose, Peas, &c., are characterised by having the whole of their mycelium superficial, or running over the surface of the part they are parasitic upon, and obtain food from the host by pushing suckers into its epidermal cells. There is, however, one exception to this rule in the white powdery mildew so common on the young shoots of Apple-trees in this and other countries. Here we appear to have a perennial mycelium in the host-plant, which grows along with the shoot each season, stunting its growth, and eventually killing the tree. In this instance it has been clearly demonstrated on a very extensive scale, and extending over several seasons, that spraying does not diminish the disease; whereas, owing to the fact that the mycelium present in the branch does not extend backwards from the point of infection, persistent removal of the diseased shoots soon exterminates the disease, especially if combined with spraying in spring to prevent fresh infection.

A similar method of treatment should be practised in the case of Peach leaf-curl, where the perennial mycelium does not extend backwards in the branch beyond the point indicated by the curled leaves.

Of the numerous kinds of microscopic fungi attacking foliage and fruit, our remarks, lacking time, must be restricted to one, the brown rot of fruit—*Monilia fructigena*, familiar to everyone under the form of numerous greyish warts, often growing in circles, on decaying Apples, Pears, Plums, Cherries, &c. Although best known to the casual observer as occurring on fruit, this fungus usually first attacks the leaves, young shoots, and flowers. In too many instances where shrivelling blossom is attributed to having been "touched by frost," the real cause is our friend or enemy *Monilia*.

On the leaves the fungus forms very thin, velvety, olive-brown patches, consisting of chains of spores, which become free at maturity, and are blown or washed by rain on to other leaves or fruit. On the fruit the disease first forms scattered brown spots, which eventually develop into the warts already described as forming circles—miniature "fairy rings" in fact. These rings often grow into each other. Such diseased fruit does not rot, but shrivels, and either hangs on the tree throughout the winter

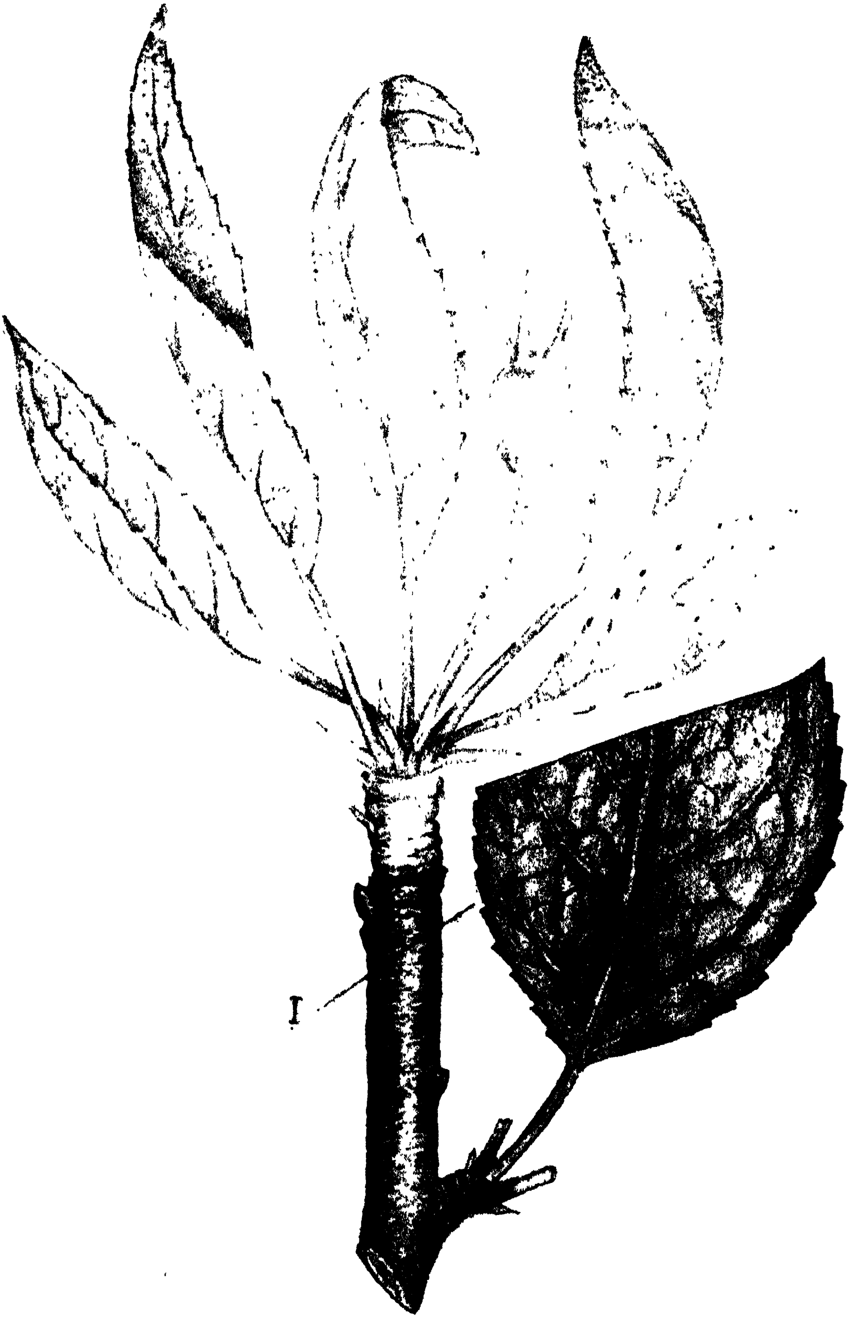

FIG. 310.—APPLE MILDEW (*Sphærotheca mali*).

As the mycelium of the fungus appears to be perennial in the tissues, diseased shoots should be removed along the line marked I. Spraying does not check this disease.

or lies on the ground in a mummified condition. Minute black sclerotia are formed in abundance on such mummified fruit, which, on the return of

FIG. 311.—BROWN ROT OF FRUIT (*Monilia fructigena*).

Showing the appearance of various kinds of fruit attacked by the fungus. The lower figure shows the fungus attacking Cherry flowers; these become brown and shrivel, and the cause is often attributed to frost.

spring, produce spores. These find their way to the leaves and blossom, and the disease commences anew. To prevent this danger all diseased Apples should be collected and burned, and the trees should be sprayed

with dilute Bordeaux mixture when the leaves are expanding, and repeated at intervals of ten days if the fungus is observed.

V.—Watering, Spraying, Mulching, Pruning.

The title of this discourse will probably suggest the idea that new methods of carrying out the routine work of the gardener are to be ventilated. This, however, will not be the case, and, except incidentally here and there, my remarks will be confined to suggesting the possible danger of introducing or facilitating the spread of disease, through lack of knowledge, in the act of watering, pruning, &c.

To commence with watering. As a rule, too much water is used, especially in houses, and unless ventilation is very carefully attended to the foliage remains damp too long, and floating spores settling on such leaves germinate readily. Now if such spores happen to belong to *Botrytis*, or other parasitic fungi that can pierce the cuticle of the leaf or enter through its stomata, there is the possibility of infection. Where open tanks for water are present in a house, such water contains numerous spores of various kinds, many of which are in active germination. When such water is used for syringing, many spores are by this means deposited on the leaves. This is more especially true when the water is collected from roofs. In one such instance it is certain that the Chrysanthemum Rust was introduced into a house by spores carried into a tank from outside, and spread on to the plants by spraying. It sometimes happens that a single plant in a house is slightly diseased and overlooked, and by syringing, the spores from this one plant are spread, and an epidemic may be started.

In addition to fungus spores, open tanks, unless very frequently thoroughly cleaned out, contain a large number of moss and algal spores, and the dense green matted growth on the soil in plant-pots is the outcome of using such water. How many seedlings in pots have been suffocated by this felt of moss and algæ gardeners alone can tell.

So far as the watering of seeds sown in pots is concerned, if water were used that had been recently boiled, no moss or alga would appear. This small amount of extra trouble would well repay, and need only be continued until the seedlings were well established.

A quart of deep rose-coloured solution of permanganate of potash mixed with the water in a tank once a week would greatly aid in destroying fungus moss or algal spores when germinating, and would also prevent to a great extent the germination of spores on the leaves. The only objection to this method is the fact that this substance, in common with potassium sulphide, discolours white or light-coloured paint.

Spraying is such an important matter, requiring experimental work to be of any real value, that it can only be touched upon in the present lecture. There is much misconception as to the object and value of spraying. It is important to remember that spraying is purely preventive work, and will not cure a disease; but if properly done, and at a sufficiently early stage, it will check the spread of an epidemic. Success in spraying depends mainly on the apparatus used; the nozzle should be

of such a construction as to deliver the liquid in as finely divided a state as possible, fog or mist being the ideal condition.

Attempting to spray with a fine syringe is practically of no use, as the liquid accumulates in drops and rolls off a smooth leaf, whereas a hairy or downy leaf is not wetted.

The fungicide sprayed on foliage does not only destroy all germinating spores present on the leaves at the time of application, but it dries on the leaf and destroys any spores that germinate until it is removed by rain syringing, &c. Bordeaux mixture is undoubtedly the most effective fungicide, and is of inestimable service for spraying nursery stock, fruit-trees, Tomatos, &c., but it cannot be used in conservatories, public parks, or show-places, on account of the disfigurement caused by the solution of lime present in the mixture.

Mulching is almost universally acknowledged as beneficial, being at the same time protective and nutritive. Undoubtedly it is of great value if applied in a proper manner and at the proper time. When mulching is allowed to remain after it is sodden and compact it prevents the necessary aëration of the soil, which in consequence becomes sour; the roots

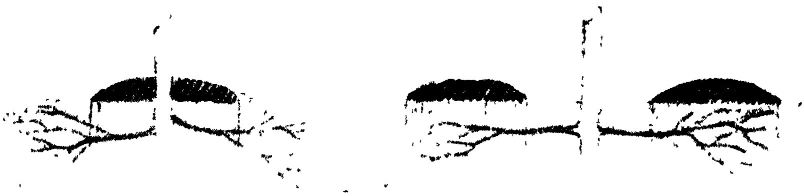

FIG. 312. —DIAGRAM ILLUSTRATING DIFFERENT METHODS OF MULCHING.

The left-hand figure illustrates a way often practised, and it will be observed that the young and active roots are neither protected from frost nor fed by the drainage from the manure. When the manure is placed in a ring at some distance from the trunk, as in the right-hand figure, both these objects are accomplished.

are thus prevented from performing their proper functions, and as a result the foliage becomes soft and is rendered very susceptible to the attacks of fungi. Opinions differ as to the proper time for mulching, some advocating autumn, others spring. When done in the autumn most of the nutritive element is lost, as when the leaves are absent the root is comparatively inactive; and from the protective point of view fibre keeps out more frost than compact manure. The only reason given by some gardeners for autumn mulching is lack of time for carrying out the operation in the spring. When mulching is done in the spring the active roots benefit by the manure, and the young shoots, as in the case of Asparagus, &c., are at the same time protected.

In the case of nursery stock, fruit-trees, &c., mulching is mainly done from a manurial point of view, and in too many instances the manure is placed close up to the trunk. Now the drainage from manure in this position misses the root in soaking through the soil. The proper position for the ring of manure is shown in the right-hand diagram, where its drainage is immediately over the active portions of the root.

Remembering the fact that wound-parasites can only gain an

entrance into plants through wounds, it can readily be understood that the act of pruning, unless the wounds made are promptly coated with gas-tar, is very likely to be the means of admitting injurious fungi into the living tissues of a tree. When pruning is done in late autumn or winter there is no bleeding, the gas-tar is absorbed by the wood, and infection prevented; whereas when done in the spring bleeding takes place, the sap oozes through the coating of tar, and fungus spores gain an entrance. It is not an unusual thing to see fungi growing from a cut surface that has been carefully protected by tar or other substance, but pruned at the wrong time.

Nowadays most people protect the cut surface of all branches of more than one inch in diameter, leaving the hundreds of smaller cut ends to take care of themselves. I am quite aware that it is not practicable or even necessary to protect the ends of all cut twigs in the case of a large tree. On the other hand, under certain conditions, it is advisable to protect every cut surface.

The accompanying figures illustrate sections of a portion of the stem of two young standard Apple-trees. When the stocks were young all the lateral branches were cut off, and not protected. The result was that a parasitic fungus gained an entrance into the stem and spread upwards. The fungus present in the tissues produced no immediate effect, and the trees continued to grow for some years afterwards. When ten years old a check in growth was experienced by the trees and the fungus that had been hitherto more or less latent became active, extended to the surface of the stem, and during the same season the trees were killed, and in addition bore a large quantity of microscopic fungi with mature spores ready to be dispersed and attack other trees. The above is not an isolated illustration; hundreds of young trees perished in the same nursery at the same time and from the same cause.

It remains with the practical man to decide whether, under the circumstances, it is not advisable to protect all cut surfaces, large and small, on such an all-important factor as the stem of a young fruit-tree; for, although disease may not show itself for some years, it is perfectly well known that many trees perish sooner or later from fungus infection introduced into the trunk while quite young.

VI.—General Summary of Leading Features Discussed in Previous Lectures.

The mode of life of many fungi is so very different from that of flowering plants that, unless the gardener is in possession of some of their peculiarities, mistakes are certain to happen. As an illustration, the branches of various kinds of Juniper are not unfrequently swollen, and covered during the spring-time with soft, gelatinous, orange bodies of irregular shape. These orange masses are clusters of spores, which produce other still smaller spores that are blown about by wind, and such of those as happen to alight on the surface of young damp leaves of the Hawthorn or Pear germinate, enter the tissues of the leaf and cause a disease, resulting in the early fall of the foliage. Now if this epidemic is repeated for

FIG. 313 – Sections of portion of stem of two standard Apple-trees, which were eventually killed by a fungus called *Eutypella prunastri*. The fungus entered the stem through wounds made by pruning, and caused the discoloration in the centre of the stem. The trees continued to grow for several years after the fungus entered, as shown by the pale healthy wood covering the diseased portion and cut ends of the pruned branches. During the eighth year after inoculation the fungus became active and killed the trees.

two or three seasons the trees so attacked are injured, or if young, as in the case of nursery stock, killed outright. The form of the fungus growing on the Plum or Hawthorn leaves resembles little yellow horns, open at the point, and occurring in clusters on a yellow spot. Much money and time has been lost at various times in the endeavour to check the spread of this disease on Hawthorns and Pears by spraying and other means, acting on the assumption that the disease spreads directly from one tree to another, which is not the case, as the spores from the Juniper alone can infect the Hawthorn and Plum; therefore, the only means of checking the disease is to seek out the infected Juniper and remove the diseased branches. Many other destructive fungi, especially those attacking cereals, also grow on different plants during different periods of their existence.

Most parasitic fungi produce at least two kinds of spores or reproductive bodies. First appear the summer spores, developed on the living host-plant; these are produced in immense numbers and in rapid succession, and are always the direct cause of a sudden spread of fungus disease, being dispersed by wind, rain, syringing, &c.; hence, at the season when plants are in the full vigour of growth, a constant watch must be kept, and on the least indication of disease the affected plants should be removed and isolated from those of their own kind. If a disease is proved to be present, all neighbouring plants, especially if of the same kind as those attacked, should be sprayed with potassium sulphide or permanganate of potash solution.

When the vigour of the host-plant begins to wane in the autumn, the formation of summer-spores ceases, and winter-spores or resting-spores are formed. The resting-spores may be produced in clusters presenting a similar appearance to those of the summer-spores, as in the case of the uredospores (=summer-spores) and the teleutospores (=winter-spores) of rusts attacking cereals, Chrysanthemums, and many other plants. or they may be quite different in form and structure and produced in special conceptacles, as in the *Nectria*, causing Apple-tree canker.

The use of winter-spores is to start the disease again the following season; and in the case of annuals, and also of perennials not having permanent mycelium of the fungus in their tissues, it is well to remember that infection can only take place through contact with resting-spores direct, or, with secondary spores produced by the germinating resting-spores that have passed the winter in the vicinity. Sclerotia are also formed in the decaying tissues of many plants that have been attacked by parasitic fungi, and these act in a manner similar to resting-spores by producing spores after a period of rest.

One of the greatest difficulties the gardener has to contend with is the danger arising from the presence of resting-spores and sclerotia. Being often firmly attached to the plant on which they are produced, they pass unharmed through the process of the host being converted into manure, and may even pass through the alimentary canal of an animal without injury; and, consequently, are in the end deposited on the land along with the manure. As previously stated, it is impossible to burn all infected plants, but in the case of garden produce there are instances where it would be well to do so, rather than run the risk of a recurrence

of a disease, for the sake of the amount of manure to be obtained from Potato-tops or dead bean-stalks.

The weeds of gardens, fields, and hedgerows also have their fungus parasites, and these have been known to pass on to cultivated plants; hence the fewer weeds the less risk of an epidemic.

The large fungi that attack fruit and other trees can only gain an entrance through some wound. Branches broken by wind or other means should be removed and the cut surface coated with gas-tar; and, more especially, great care should be taken not to wound the base of the trunk or projecting roots with the spade, grass-cutting machine, &c.

With regard to mulching, the two dangers are—the introduction of resting-spores or sclerotia along with the manure; allowing the manure to remain unmoved until it becomes compact and sodden, thereby preventing free access of air to the soil, and sourness is the result.

In pruning, the greater the number of cut surfaces protected by a coat of gas-tar the less is the risk of infection. An interval of several, even many years may elapse between the entrance of a parasitic fungus into the tissues of a tree, through an unprotected wound, and the evidence of any injurious action on its part; yet all this time it may have been quietly extending its mycelium, and during some temporary check to growth on the part of the tree manifests itself in a very unpleasant manner.

THE RESULTS OF SOME EXPERIMENTS WITH INSECTICIDES ON SOME GARDEN AND GREENHOUSE PESTS.

By R. Newstead, A.L.S., F.R.H.S., &c., Curator of the Grosvenor Museum, Chester.

[Read November 12, 1901.]

During the last few years it has been my pleasure to conduct a number of experiments with insecticides on various insects injurious to fruit-trees and plants under cultivation, with a view, if possible, to discover some of the more effectual remedies. The insecticides selected were, for the most part, those which have found most favour among horticulturists during recent years; some of which were originally discovered, after much research, by the leading entomologists of the United States of America and our Colonies. In my paper on "The Scale Insects and Mealy Bugs of the British Isles," read before the Society in October 1899, a number of insecticides were dealt with at some length, and I must ask the members of the Royal Horticultural Society to refer to that article for information bearing upon coccids and allied pests. It should be added, however, that recent experiments with the brown Peach Scale (*Lecanium persicæ*) have materially strengthened the advice then given, and I shall therefore have occasion to refer to this pest. Some attention has also been given to certain root-feeding coccids, which, as pests, are practically new to this country. I have also to lay before you the result of some extensive experiments with the "Pear-tree Slug-worm," or "Saw-fly Grub," and the caterpillars of a small Tortrix Moth, which are injurious to certain fruit-trees.

In dealing with the Pear-tree Slugworm I have also entered into some detail concerning the economy of this pest, giving some apparently new and important facts concerning its life-history, which have a practical bearing upon the application of insecticides. The observations are supplemented by photographic illustrations from life.

Particulars concerning the life-history of the Tortrix pest have already appeared in the *Gardeners' Chronicle*, but it has been thought advisable to repeat the information there given, with due acknowledgment to the editor, Dr. Maxwell T. Masters, who has also kindly supplied the block illustrating the insect in its various stages (fig. 318).

Paraffin and Soap, or "Kerosene Emulsion."

In my former paper * I claimed that this emulsion had given the most satisfactory results, and, further, that it had killed about 80 per cent. of the larvæ of the "brown Peach Scale" (*Lecanium persicæ*). Two additional annual applications have since been made upon the same lot of trees, with the result that this year very few females were found to have survived the series of applications. I cannot, therefore, too strongly recommend this emulsion for all kinds of naked "scale" and "bug" or

* *Journal of the Royal Horticultural Society*, vol. xxiii. pt. iii.

other allied insects. But the instructions previously given as to its manufacture and application must be carried out in the strictest detail in order to ensure success.

Treatment for Subterranean Mealy Bugs.

This group of underground coccids belong to the two genera *Dactylopius* and *Ripersia*. The former contains the typical mealy bugs, the females of which usually possess eight pointed antennæ, while typical Ripersia possess but six joints. The subterranean species of both genera are usually much smaller than the arboreal species, but otherwise they do not materially differ. Members of both genera have a world-wide distribution, being found in New Zealand, Australia, North and South America, Africa, and the continent of Europe, Great Britain and the Channel Islands possessing the greatest number of species. The economy of these insects is exceedingly interesting, as many of them are associated with ants in various parts of the world. Mr. W. W. Smith, of New Zealand, has shown that the interrelations of these insects are of great interest. He has found that the presence of these root-feeding coccids forms an economic basis for the origin of ants' nests, and that no less than three species belonging to the genus *Huberia* almost invariably start their new nests where the coccids have established themselves on roots of plants under stones. Mr. Smith also tells us that "if a newly-selected site be disturbed by turning over the stones . . . the coccids will occasionally leave it and the ants will disappear with them." Further, that he has seen ants "seize a coccid and carry it about the nest apparently merely to protect it. . . . When a portion of a gallery is formed or any interstices occur among the small stones in the site, the ants carry and deposit the coccids in such places of safety; in old communities they are borne into the inner galleries to be carried out to the courts of the nest when all danger is past."

In this country we have not been able to ascertain whether ants establish their new nests with root-feeding coccids; very probably they do. But their behaviour to the coccids in their nests in many instances has been found to be much the same as observed by Mr. Smith. If a nest be disturbed, the ants in many instances have been seen to carry off coccids to a place of security; but in some few instances the ants have not shown any signs of attachment to them. As "mealy bug" are known to secrete a sweet fluid, like the honeydew of the aphides, it is highly probable that these subterranean coccids possess the same power. And if this be so it would account for the interrelation, or perhaps the interdependence, of these insects.

The chief object of this communication is to call attention to a comparatively new species of root-feeding "mealy bug" (*Ripersia terrestris*, Newst.), which was described from specimens found infesting stephanotis roots near London in February 1895. Shortly afterwards it was also found in the same district on the roots of Palms. Quite recently the species has also been found infesting the roots of *Adiantum* (fig. 814) to such an extent as to produce a marked effect upon the foliage of the plants, causing it to turn brown, as in plants too much dried at the roots.

This coccid is one of the smallest of its tribe, measuring only $\frac{1}{25}$ to $\frac{2}{25}$ of an inch in length. By boiling specimens in caustic potash the true character of the insect may be seen under a good microscope. The

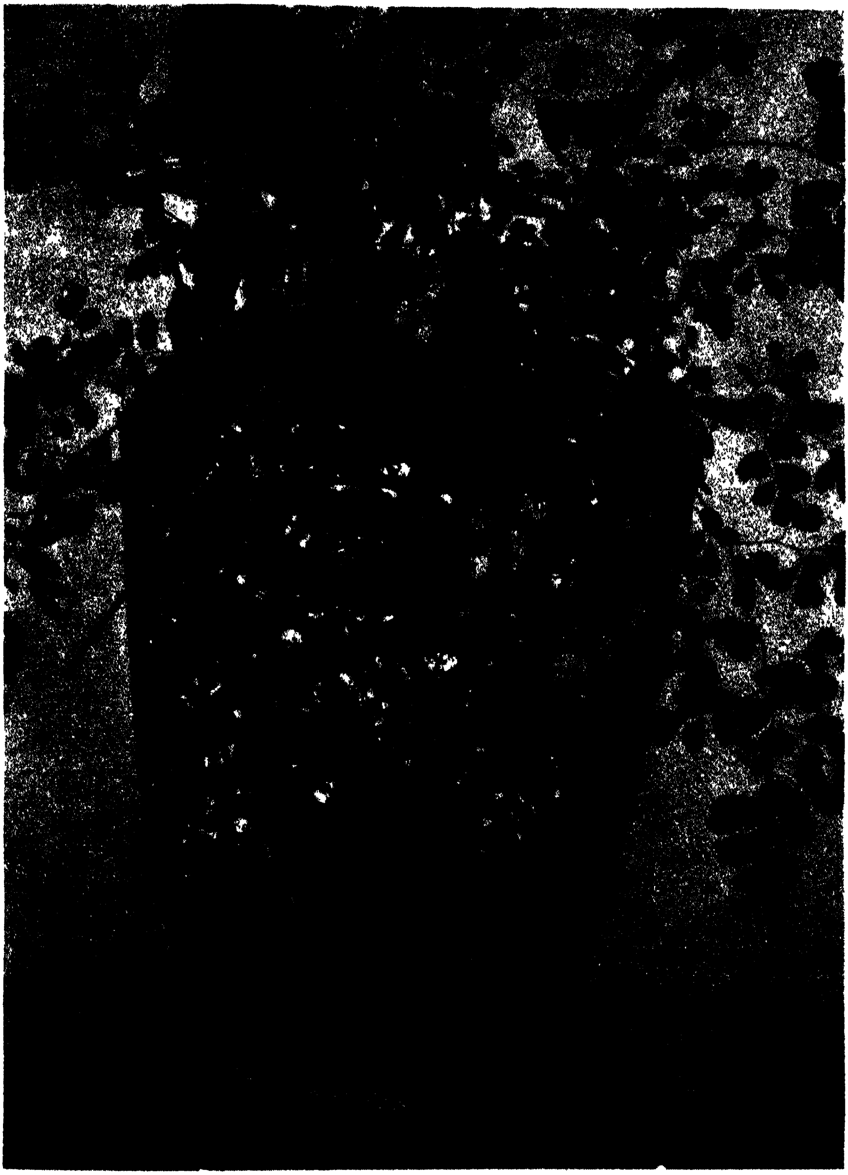

Fig. 314.—Subterranean Mealy Bug (*Ripersia terrestris*, Newst.) on Roots of Adiantum (nat. size).

horns (antennæ) are elbowed or bent backwards to enable the insect the more readily to burrow or move about in the narrow passages of its habitat. The legs are well formed, and there is a very strong muscle or lever-like organ attached to the front pair of legs which no doubt gives

them additional powers for burrowing. The mouth-organs are placed between the front pair of legs, which consists of the usual projecting two-jointed chin (mentum) with the hair-like sucking-tube extending beyond them, and terminating in a loop. On the upper surface are two pairs of large eye-like glands and a number of minute pores or spinnerets which secrete the mealy substance which covers them and also the fine woolly filaments which form their egg-sacs and retreats among the roots of the food-plants.

In pot-plants the insects chiefly reside among the outside roots (fig. 314), next to the side of the flowerpot. In such situations they live and lay their eggs. Their woolly retreats appear to be perfectly non-absorbent, and no doubt afford the insects the necessary protection against excessive moisture.

The origin of this pest has not yet been discovered. In all probability it is an indigenous species, and may have been introduced in the potting material. It may, however, have been introduced on imported plants.

There is also another subterranean species (*Dactylopius radicum*, Newst.) which I have found to cause serious injury to Strawberries cultivated in pots. In this case there could be no doubt that the coccids were introduced with the fresh turf used in the cultivation of the plants. Externally this species very closely resembles the preceding, but in point of size it is a trifle larger. It secretes a similar white woolly material in which it lives and lays its eggs, and also, like the preceding species, prefers to live on the outside roots. In a state of nature it lives chiefly upon grass-roots, but has also been found on the roots of the Sea Pink (*Armeria maritima*), upon which plant it was first discovered on Puffin Island, off the coast of Carnarvonshire.

In both species the woolly fibres bear a striking resemblance to the fine white mycelium of a fungus commonly met with on grass-roots, and it is feared the insects may have been overlooked, and passed off as "fungus spawn." It is hoped, therefore, that these observations may serve to identify these undesirable pests; and that all turf intended for potting purposes should be inspected, and more especially so that which is of a light loamy nature.

Treatment:—

(1) Never, if possible, use the outside of turf-stacks or fresh turf for potting purposes.

(2) Do not turn the infested plants out of the pots while in the conservatory.

(3) Infested plants should have all soil removed from the roots and the latter thoroughly washed in clean water. The pots from the infested plants should be immersed in scalding water or heated to destroy any adhering eggs or insects.

(4) To destroy the insects on growing plants, remove the pots and thoroughly spray the exposed roots and soil with carbon bisulphide (CS_2), using a small glass spraying apparatus. Scald the pot and have it ready for replacing *immediately* after spraying. Eggs are not destroyed by this means, and it will be found

necessary to repeat the application. Keep the plants well in the shade for a week or more after spraying. I have not found the carbon bisulphide injurious to Maidenhair Ferns while in active growth, but in no case must the plants be exposed to the sun.

THE PEAR-TREE SAW-FLY, OR SLUGWORM (*Selandria atra*).

Although this insect is not so universally destructive as many of our fruit pests, it is decidedly one of the most injurious to wall-trained fruit-trees, and when once established is very persistent in its attacks, often destroying successions of crops year by year as the seasons come.

My experiments with this pest began in the year 1899, upon a series of wall-trained Pears and Cherries, the nature of the infestation being

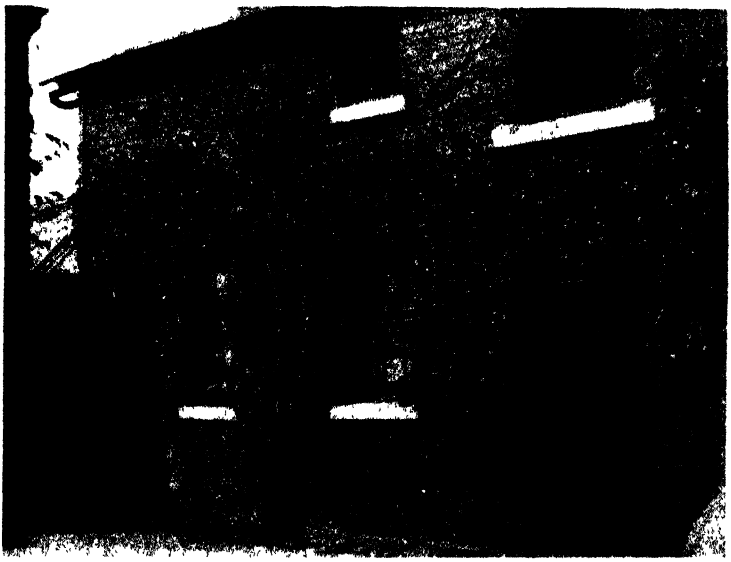

FIG. 315. -PEAR-TREE PARTLY DEFOLIATED BY SLUGWORMS, JULY 1899.

one of the worst I have ever seen (fig. 315), and one, I am informed, of very long standing.

It is when the leaves are well formed in the spring that the parent fly appears and lays its eggs. This is accomplished in a rather interesting way. The female fixes herself to the underside of a leaf and with her ovipositor makes a slit through the leaf to the upper surface, leaving the bare epidermal layer intact. The egg is placed immediately beneath the latter, and is clearly visible to the naked eye as a sub-circular spot, varying in colour according to the age of the egg. The latter is of a pale leaf-green, sub-circular, flat beneath, and low convex above. In the course of a few days the young larva hatches from the egg, cutting its way through the shell and epidermis of the leaf much in the same way as a moth larva. All through its existence the larva feeds upon the upper surface of the leaf, leaving the nervures untouched as a skeleton network, with the

result that the leaf turns brown and in time falls from the tree. The first brood of grubs are full fed about the middle of June. They descend to the ground, spin their cocoons, and therein turn to pupæ. In August I have found the insects in all stages, viz.: eggs, larvæ in all stages, pupæ, and perfect insects. There are, therefore, at least two broods in a year, and in all probability more, and, as in the Gooseberry saw-fly, there appears to be a good deal of overlapping of the broods during the latter part of the summer. The cocoon (figs. 316, 317) is about one quarter of an inch long; it is formed by cementing together the surrounding grains of sand or earth, and is therefore of precisely the same colour as the surrounding earth, which renders it very obscure and difficult to find when in comparatively small numbers. The exact spots where the grubs pupate, or rather spin their cocoons, are all along the wall, about one inch below the surface, and also upon the roots of the trees where the bark is roughest. In the latter

FIG. 316.—COCOONS OF SLUGWORM ON ROOTS OF PEAR. (Natural size. Original.)

position (fig. 316) they are extremely hard to find, but they are much more easily detected when adhering to the wall. In the latter position I have found them clustered together, forming a mass nearly one inch thick (fig. 317 A-C) and extending along the entire length of the wall on which the trees were trained; and where the cocoons were thickest they averaged 500 to the lineal foot. Thus under one tree covering a space of 20 feet, some 10,000 cocoons were found. Although of a very brittle nature, the cocoons were very firmly attached to the wall, and when removed many of them brought away fragments of brick and mortar with them. I should also add that the larvæ in many instances had burrowed into the mortar between the bricks, forming their cocoons with the dislodged materials (fig. 317 A).

Treatment:—

(1) Remove all surface soil to a depth of four inches, and to a

distance of at least two feet from the wall, and three feet all round the stem of the tree. Scrape off all the cocoons from the wall and from the roots of the tree, taking care to collect them as they fall and finally have them burnt. The soil should be deeply buried or subjected to great heat. Boiling water poured upon it has little or no effect upon the pupæ.

(2) Spray the tree, on the first appearance of the larvæ, with Paris green (POISON). The first application, when the leaves are tender, at the rate of 1 oz. to 20 gallons of water. The second application from middle of July onwards, at the rate of 2 oz. to 20 gallons of water.

The Paris green should be of the purest kind, such as supplied by

A B

FIG. 317.—A. Cluster of cocoons of Slugworm, attached and partly formed in mortar (surface next to wall).
B. Cluster of cocoons (about 100) detached from wall (outer surface).
C. A similar cluster with several pupæ exposed (surface next to wall).
D. Cloth shred, partly imbedded in lime, through which a slugworm has bored (*d*) in order to get to earth to pupate. (All natural size. Original.)

Blundell, Spence & Co., and preference should be given to that which is sold in the form of a paste.

By adopting the treatment set forth in (1) and (2) I have succeeded in almost exterminating the pest. But it is only fair to add that this result was obtained after considerable time had been spent on experiments with other insecticides, of which I append a summary :

(1) Lime.—Two dressings of dry slaked lime were applied to the larvæ while feeding. Result *nil*.

This method is frequently recommended as being effectual in destroying the larvæ. In my experiments they seemed not at all affected by the application.

A very thick dressing of lime was also applied to the surface of the ground beneath the trees, with a view to destroying the larvæ when descending to pupate. Result as above. After the lime had weathered down and formed a somewhat solid layer, the larvæ bored through it and pupated beneath. (See photograph, fig. 317 *d*.)

(2) Hot water applied with a syringe at a temperature of 180 F. This dislodged a few larvæ, but did not kill them.

(3) Paris green, obtained from a local chemist. *Two* applications. Result *nil*.

(4) "Paraffin or Kerosene Emulsion."

Two applications were made of this—one hot, the other cold. Result *nil*.

N.B.—A Stott syringe was used to apply the insecticides.

FRUIT-TREE TORTRIX
(*Penthina variegana, Hubner*).

In the *Gardeners' Chronicle* for June 1901, p. 342, I gave a description of this moth, accompanied by drawings illustrating its various transformations.

This insect has of recent years been very destructive to the Plum, Apricot, Cherry, and Pear, occasionally attacking also the Rose. It appears, however, to be much restricted in its distribution as a pest, but I believe it occurs in most of our English counties.

The following description of the insect in its various states is taken, with due acknowledgment, from the *Gardeners' Chronicle* :—

The caterpillars of this moth hatch from the eggs in the autumn, and after feeding a short while they make for themselves little galleries or cocoons on the bark of the tree (fig. 318, 6 × × ×). These cocoons are chiefly composed of finely-spun silk, covered externally with tiny pieces of foreign substances—portions of bud-scales, leaves, human hair, dirt, &c., and sometimes the grubs bite off the outer layer of the bark or a bud, and utilise it in the same way. So effectually are the galleries concealed on the rough bark that it is almost impossible to find them, and they are in no way conspicuous even on the smooth bark of a young shoot. In these snug retreats the caterpillar passes the winter, finally abandoning them in the spring, so soon as the flowers and young leaves appear. Their habit, afterwards like that of many allied species, is to live concealed between the leaves of the food-plant, which they effectually fasten together by means of silken threads, and sometimes they will also turn down a portion of the leaf, as shown at fig. 318, 5A. The caterpillars live in these retreats, and in them spin their cocoons, and towards the end of May change to the chrysalis stage.

Oddly enough, the caterpillar's retreat often consists of one living and one dead leaf, and sometimes two or more individuals tenant the same domicile. The young caterpillars feed chiefly upon the upper surface of the leaves, leaving a network of veins (fig. 318, 5) in the same way

as the Pear-tree "slugworm." About the beginning of the second week in June the moths begin to appear, and a week later very few remain to hatch from the chrysalis. Immediately prior to the escape of the moth, the chrysalis bursts through the bonds of silk forming its frail cocoon, and works the anterior portion of its body to the outside of its retreat. The pupal skin then bursts and liberates the imprisoned moth, while the empty skin remains behind (fig. 318, 2A), anchored to the silken cocoon by means of hooked bristles with which the tail is furnished.

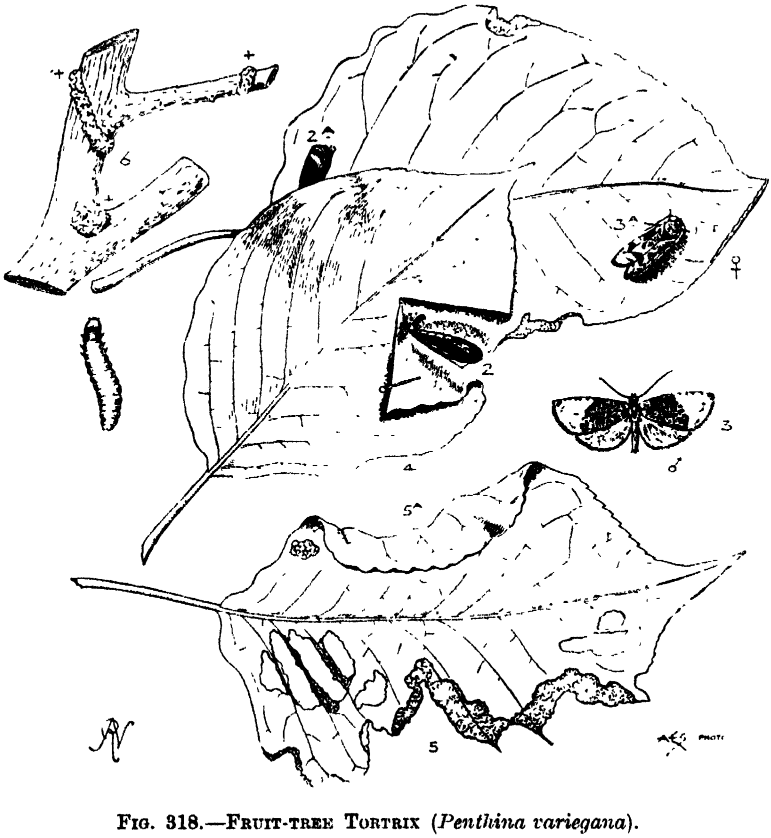

FIG. 318.—FRUIT-TREE TORTRIX (*Penthina variegana*).

(1) Caterpillar; (2, 2A) chrysalis; (3, 3A) perfect insects at rest, natural position, and with the wings expanded; (4) chrysalis hidden between two leaves spun together—the upper leaf is cut open and pinned back to show the chrysalis; (5) edge of leaf turned down by caterpillar; (6) winter galleries or cocoons in which the young caterpillars hibernate. (All actual size.)

The full-fed caterpillar (fig. 318, 1) is about five-eighths of an inch long (16 to 19 mm.), and rather stout; the colour is leaf-green above, with a rather indistinct bluish dorsal line, with the head and first segment intense, shining black, underside paler; and there are numerous fine hairs scattered over the body.

The chrysalis (fig. 318, 2, 2A) is at first of a pale greenish colour, but soon changes to a uniform dull black.

The moths (fig. 318, 3, 3A), which were bred from the Pear and Cherry, are exceptionally fine specimens, and much larger than examples described by Stainton, the largest specimen measuring 10 lines (18 to 20 mm.). The basal portion of the fore-wings is of a dark leaden-grey colour, frequently with inconspicuous brownish markings. There is usually a conspicuous black spot in the centre of the wing, at the extreme edge of the dark portion of the wing, and another variously-shaped black mark beneath it; these, together with the dark outline, frequently bear a striking resemblance to the profile of a boar's head.

The apical half of the wings is white, or ochreous-white, with a row of black spots on the front edge (costa), a minute crescent-shaped mark at the tip, and variously disposed, faint, leaden-grey cloudings. There is also, not infrequently, one or more small black dots opposite the large spot which forms the eye in the mask-like markings; the hind wings are leaden-grey, with the fringe paler. When at rest, this moth bears a striking resemblance to bird-droppings.

Treatment:—

Make an application of Paris green at the rate of 3 oz. to 20 gallons of water just as the buds are bursting (not after the leaves have expanded), and the second one when the larvæ have spun the leaves together, at the rate of 2 oz. to 20 gallons of water.

Much the same remedies were applied to this pest as to the previous one, and with much the same result, the Paris green obtained from a local chemist also proving useless.

Besides the foregoing, I have also conducted experiments upon plant-lice infesting fruit-trees and Tomatos in the open air, American blight, and caterpillars affecting herbaceous plants in town gardens. The results so far obtained are either negative or have proved ineffective, and must remain for further investigation.

INDIAN MANGOS.

By C. Maries, F.L.S., V.M.H.

During my last visit to England I noticed articles about Mangos in the newspapers, and I saw some fine fruit of a good Bombay variety (Peáry or Peter) in a shop near New Street Station, Birmingham, priced 4*d.* each. This fruit would cost that in Bombay market. I also heard of consignments of fruit being sent from Bombay, but I never knew if the venture was profitable or not. I think the ordinary English fruit-eater is tempted more by the cheapness of a new fruit than by its looks, and

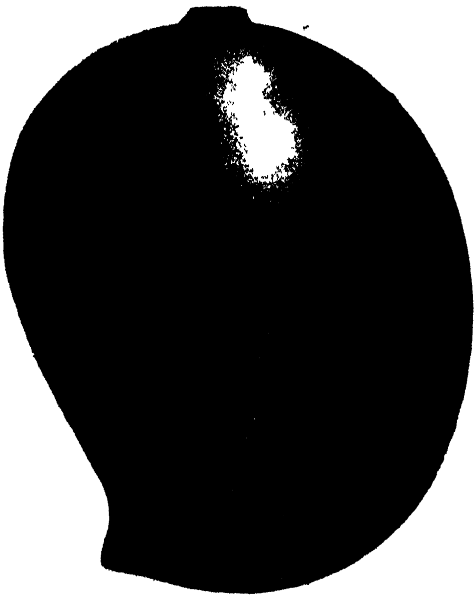

Fig. 319.—Nakkua or Nose Mango.

Colour—Pale golden yellow at the apex, passing gradually into orange-red at the stalk, and with a rosy-whitish bloom.

very few would give 4*d.* even, except for curiosity, and a Mango being a fruit most difficult to judge of the stage of its ripeness, the probability is the buyer would not waste another 4*d.* on such fruit. On the other hand, he might perhaps get a really good one, and if he did he would never forget it. It will be a long time before Mangos can be landed in England for 1*d.* each. That is about the price paid in Mango districts here in India, six rupees a hundred. With Mangos all depends upon the stage of their ripeness. If too ripe, a rotten turnip is better; or, if too unripe, the "tow and turpentine" is predominant. They are even worse than Melons to judge of the proper stage of ripeness in which to eat them, and one day too much or too little makes all the difference in flavour. Then again England, except on very hot days, is not the

country to eat Mangos in. A hot day, about 90 deg. in the shade, and a fine ripe Mango just taken off the ice after breakfast, in the morning, is a thing one will never get in England as we do in India. So the Mango stands a poor chance of ever becoming a favourite in Great Britain or a profitable fruit to send; and until the vendor of the fruit knows exactly when as to ripeness and what variety to sell his customers, the chance of the Mango is, I fear, not much.

There are many people, however, living or travelling abroad who would like to know the names of the best varieties. The following list may also conjure up pleasurable remembrances in many readers in England, old residents in India, who had their garden and favourite Mango-tree.

Mangos in India are propagated by inarching, which is the best method when properly done. It does not matter much with the native gardener if a bit of string is left on or two inches of "snag" is left to grow over. One of his reasons for having a "graft" is because it "bears better." The "bit of string," or the rotten end of the stem, is not taken into consideration. Grafts made as they are made here would never live in England; but in this country Nature repairs a lot of bad carpenter's work in the way of inarching, and even from Government gardens, where professional Europeans superintend the work, the "grafts" are just as bad as it is possible to make them. Seedlings give good results if seed is properly selected, and I would advise intending planters in the Colonies to import fruit and sow the seeds in layers, in trays of soil, instead of buying "grafts," which in some localities are "made specially" for the market, and consist of two seedlings tied together. Verily the ways of the native gardener "are peculiar."

The general idea in India amongst Europeans about Mangos is that there are four good varieties—Bombays, Maldahs, Lengeras, and Budays. These names really mean four large classes of fruit, and the sub-varieties of each are endless. I myself collected over 500 varieties in Durbhungah, in North-West Bengal, one of the homes of the Mango. To illustrate the shapes of these four great classes, I refer to the figures of "Afooz" (fig. 321) and "Durbhungah Bombay" (fig. 322) for the Bombays; "Amun" (fig. 323), "Sha Pusund" (fig. 325), and "Buckley's Gowraya" (fig. 330) for the Maldahs; "Barka" (fig. 331) for the Lengeras. The Budays are of all shapes, and ripen in the month of Bhádon, the fifth month of the Hindu year. The Budays are very little known, and are seldom seen in the Bazaars. One of the best, named "Fuzhe," can be bought in Calcutta in September, sometimes at about 8*d*. each; it is a large, fine fruit, weighing often 2 lb. each. Most of the good varieties of Budays fetch from 6 to 10 rupees per 100 in Durbhungah Bazaar, where they are plentiful.

Some of the terms used in my description of the fruit are curious. "Nák," or Nose, is the native name for the point where the pistil was situated on the young fruit when it was in the flower, and where also the root comes out of the seed.

During my seven years' sojourn in Tirhoot, the "Garden of India," I collected all the finest varieties of Mangos in India, most of which were planted in the Maharajah of Durbhungah's grounds. The Mango season lasted for five months. We had one variety, a perpetual bearer,

called "Baramassia," or the "Twelve months" Mango, *always* flowering and fruiting, but it was of very inferior quality.

Mangos in damp, wet countries grow best on mounds. They will also grow, it is true, in a swamp, but raised ground well drained is best.

FIG. 320.—BRANCH OF A MANGO-TREE IN FRUIT.

In dry, hot places you cannot irrigate too much during the hot months, always drying them up for three or four months after the rains, if possible. I have often seen fruits hanging on the tree with a root hanging out of the fruit, having germinated as it hung.

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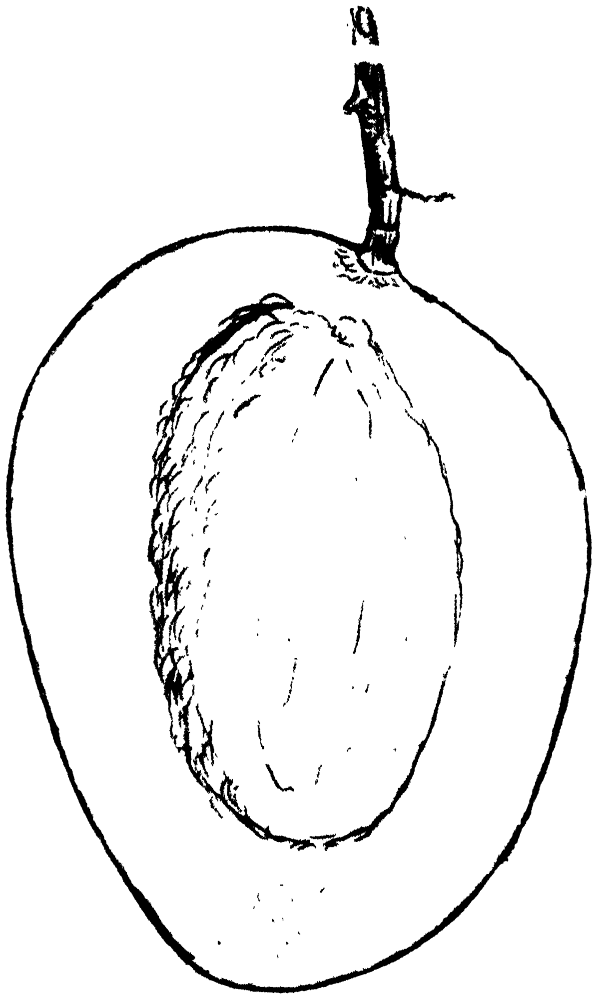


FIG. 321.—AFOOZ = ALFONZO—THE BOMBAY MANGO.

Weight	8 to 12 oz.	*Stalk*	Level with the fruit.
Season	May.	*Flesh*	Reddish.
Colour	Fine orange.	*Stone*	Large, hard, no fibre.

A lovely-looking fruit, with a vanilla-like aroma. The flavour is also rather strong of vanilla—a most delicious fruit, and a general favourite. Personally, I cannot eat them, but prefer the milder flavoured ones. This variety originally came from Salem, in Madras Province, but is now generally grown in Bombay gardens. One native gentleman told me he often got 60 rupees a hundred for his fruit, but his specimens generally weigh 12 oz. each, and are the finest I have seen.

fruits upon it, but is only a fair specimen of what a large tree in fruit is like (fig. 320)

FIG. 322.—DURBHUNGAH BOMBAY.

Weight	. 6 to 9 oz.	*Stalk* .	. Always slightly raised up from the fruit.
Season	. May, June.		
Colour .	. Generally green, or greenish yellow.	*Flesh* .	. Reddish.
		Stone .	. Hard, fibrous.

A first-rate Mango, grown in Bengal in large quantities. They can be bought in a good season at 100 fruits for one rupee. They are sent away by train-loads to all parts of India from Durbhungah and Tirhoot generally. A fine cropper, and a hardy and handsome tree.

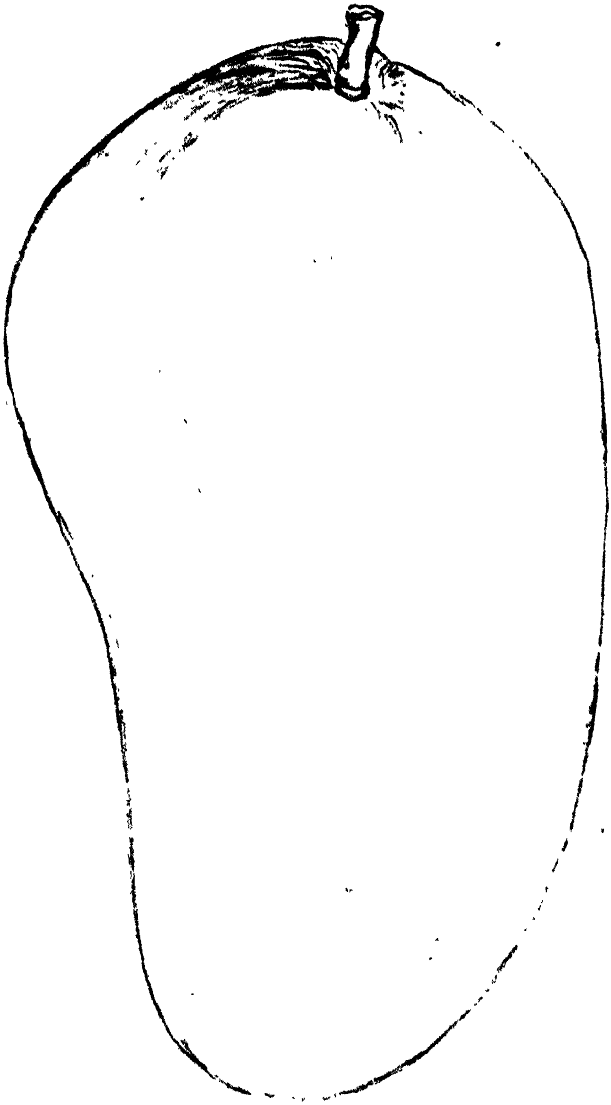


FIG. 323.—FAKEERA OR FAKIR WALLA; AMUN OF GWALIOR (Dr. Bonavia).

Weight	. 12 to 16 oz.	*Nose* .	. None.
Season	. June.	*Stalk*	. Irregularly placed, slightly depressed in good fruit.
Colour.	. Green, greenish yellow, whitish bloom.	*Flesh*	. Deep yellow.

Dr. Bonavia says: "Flavour superb, with a mixture of sweet and sub-acid, like that of a good Peach." I quite agree with him. The fruits are variable in shape, sometimes lumpy and ugly. Two varieties of it called Cucumber and Kurela Mangos are common in Durbhungah; both are fine fruit, and distinct. The "Kurela" is covered with little warts all over the skin.

Most of the good varieties are accidental seedlings. No attempt has been made in selection of seeds, except in Durbhungah. I left before I saw the results of experiments made there, and am afraid no one cared to keep up the experiments. Akbar, the great Mogul Emperor, and his generals did a great deal to plant India with Mangos. So says an old Mahomedan gentleman, a friend of mine. There remain still near Durbhungah many trees of what is called the "Lac Bagh," or the garden of one hundred thousand trees. Those I saw were four to five feet

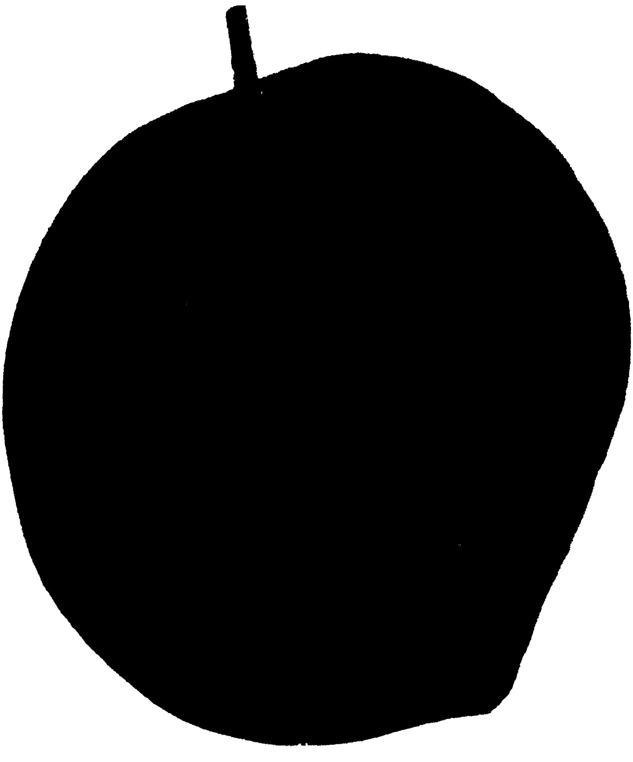


Fig. 324.—Peáry or Pairi, or Peter, or Perara, from Bombay.

Weight	8 to 10 oz.	*Stalk*	Slightly depressed.
Season	End of April.	*Flesh*	Orange; stone roundish, often fibrous.
Colour	Green, reddish, with dull crimson cheeks.	*Flavour*	Strong vanilla.
Nose	Well defined, often large.	*Skin*	Rather thick and granular.

The second best Mango from Bombay. Large quantities are grown all along the west coast and in Madras.

in diameter—immense trees forty-five feet apart. Akbar reigned 1556–1605, and he left his mark in Mango gardens all over Northern and Central India, as well as on his coins. What a difference this to the temper of people nowadays! Most people would say: "What is the use of planting trees? I shall never see them grow up and fruit." But all the same they are thankful for these lovely, shady groves Akbar planted, particularly when they are in camp on a hot day.

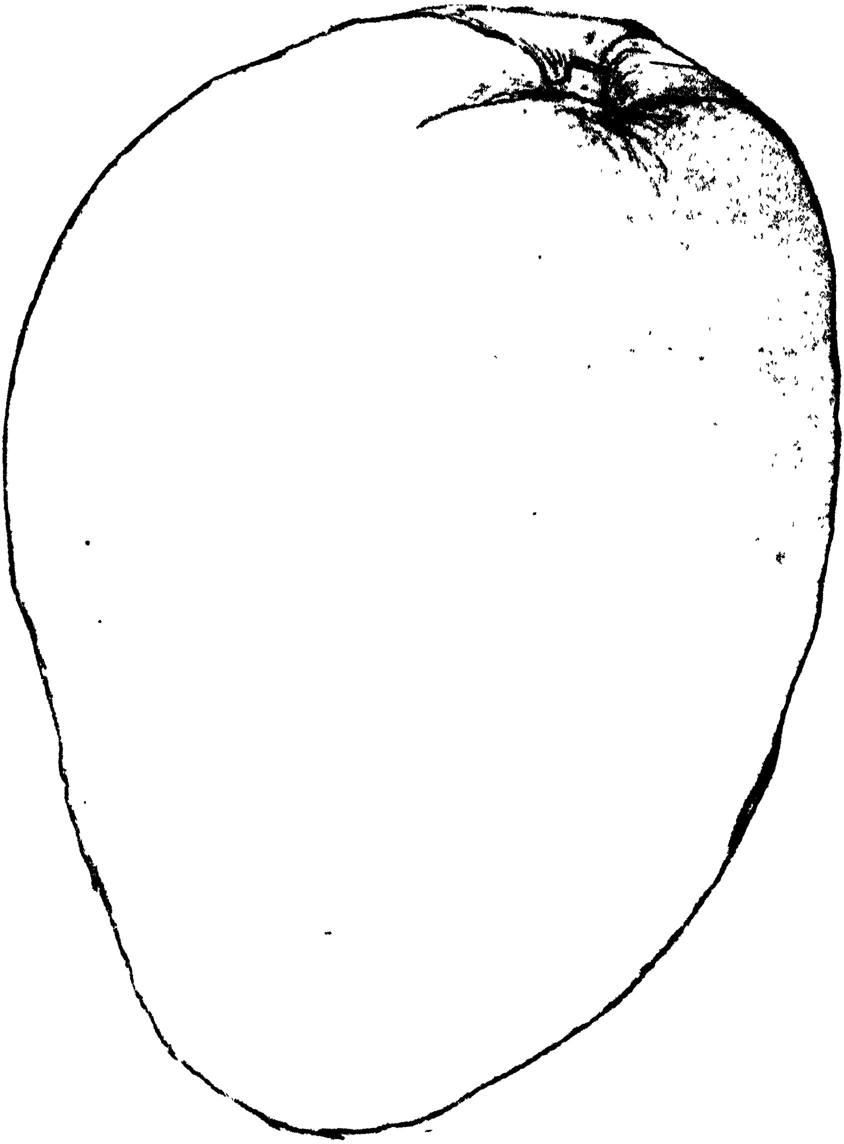


FIG. 325.—SHAH PUSUND = "DELIGHT OF THE SHAH."

Weight .	. Up to 2 lb. 3 oz.	*Stalk* .	. Depressed.
Season .	. End of June.	*Stone* .	. Soft and thin, no fibre.
Colour .	. Glaucous green, occasionally yellowish.	*Skin* .	. Lumpy.
		Specks .	. Greenish white.
Nose .	. Generally represented by a slight depression.	*Shape* .	. Irregular.

One of the commonest and largest Mangos, and when you get a good ripe one it is one of the finest varieties. It is mild flavoured and very refreshing. The fruits are very variable in shape, being often roundish, lumpy, and ugly.

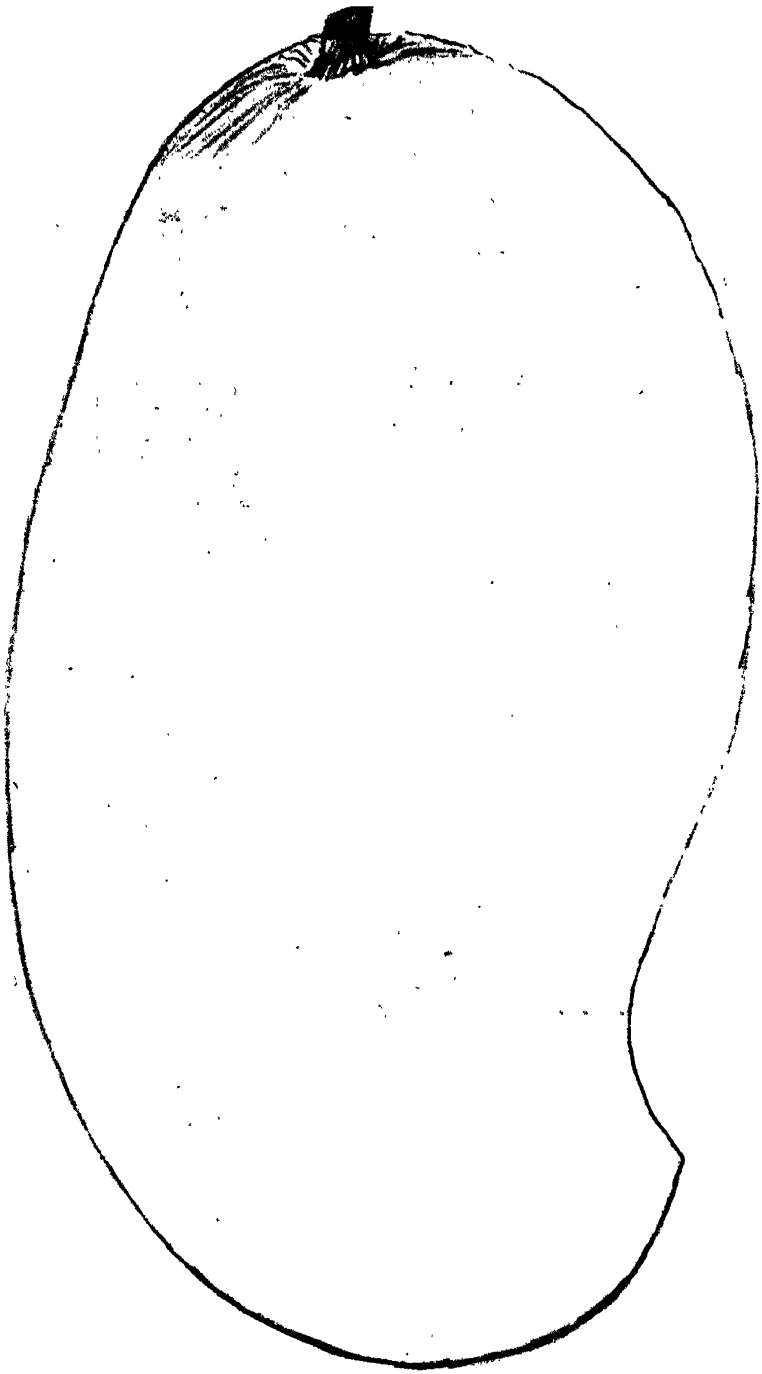


FIG. 326.—ENNURRIVA = "SPONTANEOUS."

Weight .	2 to 6 lb.	*Nose* : .	Well defined.
Season .	July.	*Flesh* . .	Reddish.
Colour .	Dark green, whitish bloom.	*Stone* . .	Thin, no fibre.

This is the largest Mango I ever saw. Fruit from plants I sent to Lahore weighed 6 lb. each. It is of fine, delicate flavour. It derives its name from the fact of its having come up spontaneously as a chance seedling in the garden of a native gentleman of my acquaintance. There was only one seedling plant at Durbhungah where I propagated it and distributed it.

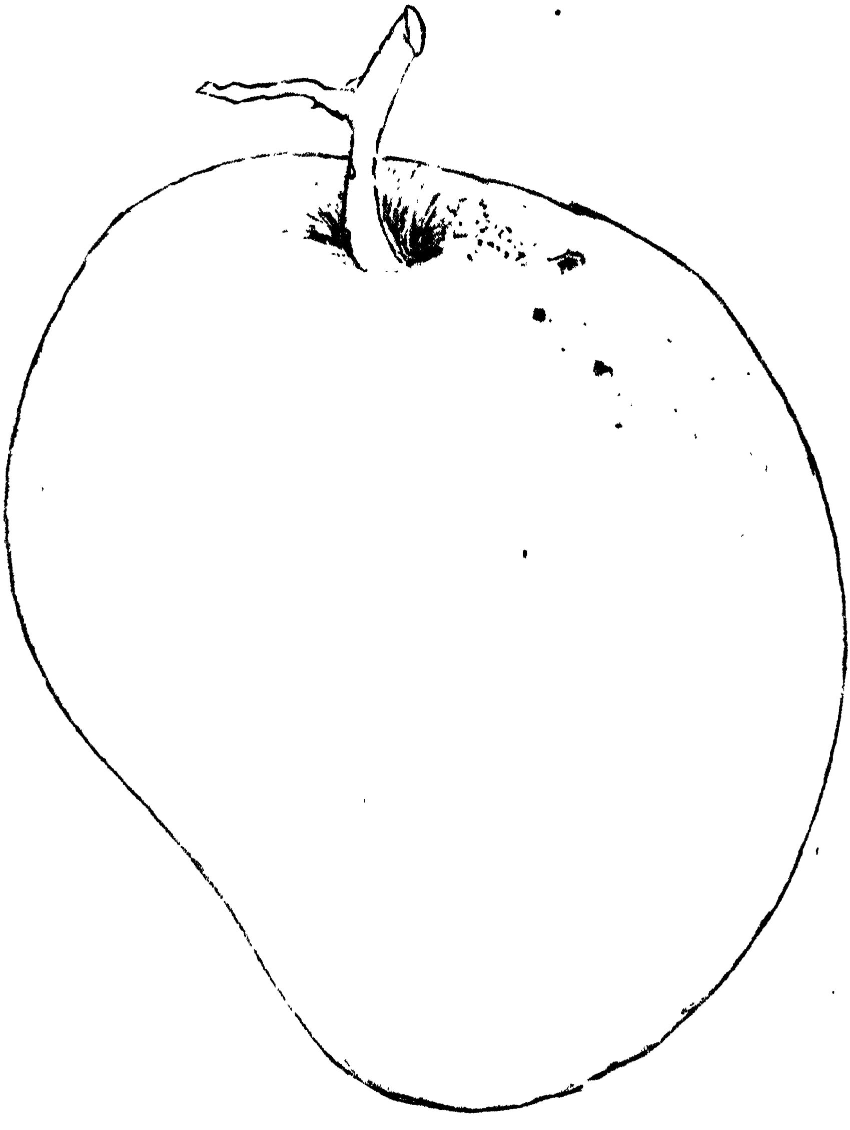


FIG. 327.—AMEER GOLAH OR GOLA, MADRAS.

Weight	1 lb. 14 oz.	*Nose*	Represented by a depression.
Season	June, July.	*Stalk*	Very much depressed.
Colour	Light yellowish apple green.	*Flesh*	Dark maize.

This is a fine fruit, and would do for Chutney, as it is sour, but of fine flavour; a very handsome fruit. Some people are very fond of it. I got it from the Madras Horticultural Society, where most of the best Madras Mangos can be bought.

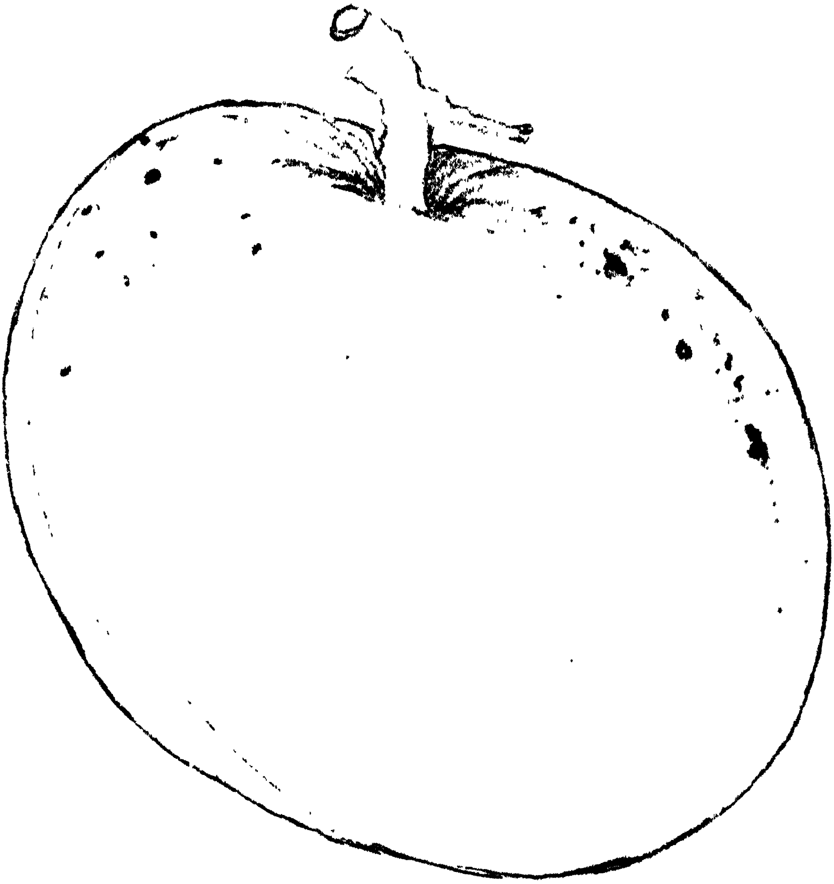


FIG. 328.—VALAJAH PUSUND, MADRAS.

Weight	14 to 17 oz.	*Nose*	None.
Season	July.	*Stalk*	Depressed.
Colour	Green to reddish orange.	*Flesh*	Light straw colour.

A fine distinct fruit, with fine aroma, delicate flavour, and firm flesh. The shape of this Mango is very distinct. From Horticultural Society, Madras.

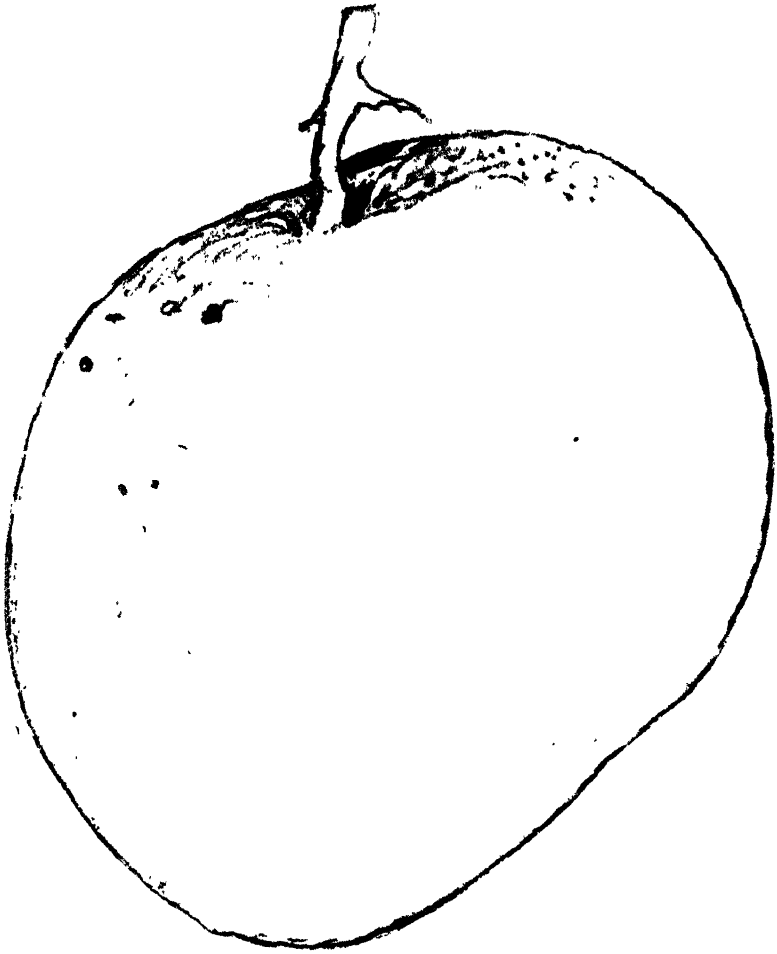


FIG. 329.—"DHARMA" = NAME OF A GOD, OR "ABOVE ESTIMATION"

Weight	12 to 14 oz.	*Stalk*	Much depressed.
Season	July.	*Flesh*	Yellow, thick.
Colour	Yellow, or light green.	*Stone*	Small, no fibre.
Nose	None.		

This is one of the finest fruits I have ever eaten. There are several varieties of it. It is splendid-looking fruit. I got it in Durbhungah and Mozufferpore. There is only one other Mango to compare with it, the Gowraya "Maldah."

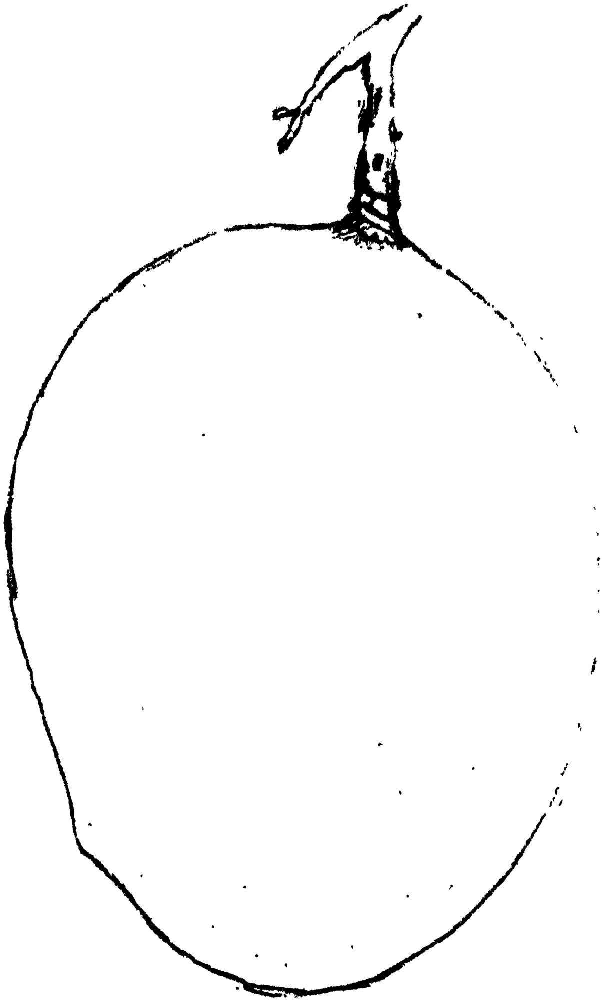


FIG. 330.—BUCKLEY'S GOWRAYA, MALDAH AND DURBHUNGAH.

Weight	8 to 12 oz.	*Nose*	Generally well marked.
Season	July.	*Stalk*	Much raised.
Colour	Whitish green and yellow, covered with minute specks.		

This is my ideal of a good Mango. Dr. Bonavia sent it to me from Lucknow, under the name of "Tikari," but it was an inferior variety. The fruit iced on a hot day is past all description. It is more like a splendid Mangosteen for flavour, without the objectionable "cotton." It is common in Tirhoot, Maldah, and now in Gwalior.

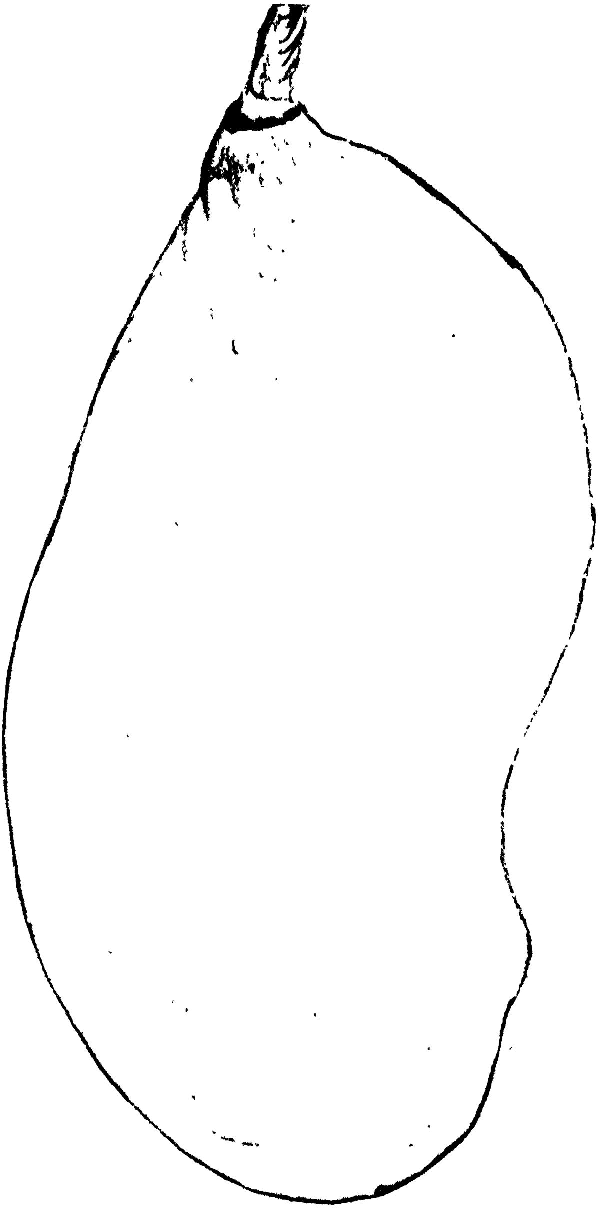


Fig. 331.—"Barka" = twisted, or in Tirhoot a "Fop," a man with his head on one side.

Weight . .	1 lb.	*Stalk* . .	Much raised.
Season . .	July.	*Flesh* . .	Red.
Colour . .	Dark green.		

This is a strong-flavoured fruit. I only give it as being one of the curious fruits. It should be in collections as a curiosity. It is rare in Durbhungah.

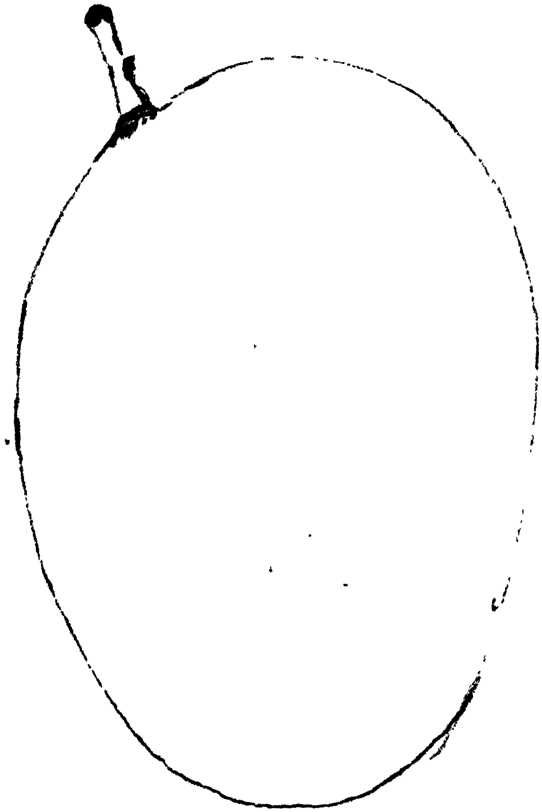


FIG. 332.—RHARI BUDAYA, DURBHUNGAH.

Weight	9 oz.	*Nose*	Very small.
Season	August.	*Stalk*	Level with fruit.
Colour	Generally dark green, sometimes reddish or glaucous.	*Flesh*	Yellow.
		Stone	Roundish, hard, a little fibre.

A fine-flavoured late variety, coming into season first of the late-fruiting varieties. We have this in Gwalior now. I grafted the first in a garden in Durbhungah.

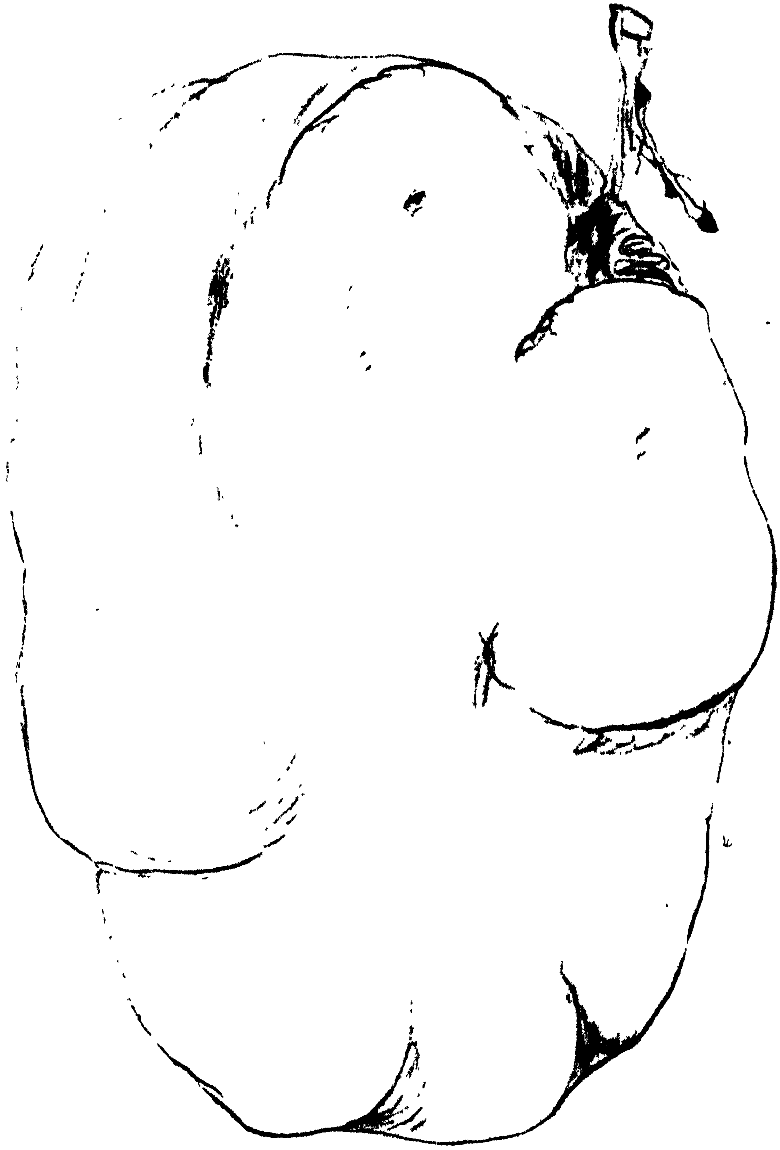


FIG. 333.—"MOHUR TAKOOR" = the name of a religious man covered with deformities.

Weight .	. Very variable, from 8 oz. to 2 lb.	*Stalk* .	. Depressed.
Season .	. July to November.	*Flesh* .	. Dark reddish.
Colour .	. Variable, generally dirty green.	*Stone* .	. Small, thin.

A first-class Durbhungah fruit when left on the tree to ripen. When ripe they require keeping for about three days before eating. This is one of the most curious fruits I ever saw. They are generally ripened on the tree in small bamboo baskets, so that flies and moths cannot eat them. When the basket *falls* the fruit is ripe. This fruit is much prized, and can never be bought in the bazaars.

A PUBLIC HORTICULTURAL GARDEN.

A Suggested Arrangement for Exhibiting the Beauties of Plant Life.

By Jos. Forsyth Johnson, F.R.H.S., New York, U.S.A.

(Consulting Landscape Gardener and Garden Architect. Author of "Natural Principles of Landscape Gardening," "Residential Sites and Environments," "Model Home Grounds," &c.)

There is a great field for rapid progress in the development of plant life in America. A few years ago extensive cultivated gardens and parks were, generally, unknown in this busy land. The grounds surrounding a residence were planted with grass only, and called a "yard"; then in the process of evolution trees were planted, here and there, to satisfy the individual longing for Nature's beauties. During the latter part of the century just closed the final impetus was given; parks and gardens sprang up in all directions like fairy visions, and in both public and private life the growing of flowers commenced all over the cultivated home-lands. If this progress and advance continue at the same rate America will soon become a veritable garden of flowers.

I here offer, from my numerous studies, a plan for a public garden. It is a design for the development of plant life, showing the variations and impressions of form and colour in growing plants.

Of the thousands of views to be found in this plan the arrangement provides that no two are exactly alike, and the general and detailed effects are thoroughly harmonised.

The plan is for a plot of land fifty acres in extent, and all that is shown on the design can be developed within that area.

The centre is supposed to be low ground; but the bottom of the garden is the lowest, falling, naturally, towards the water—a contour of land quite common, of course, where there are any marked undulations.

Land of a flat character, however, can be used effectively, but if undulation is wanted money will easily procure the exact rise and fall desired.

Buildings.

The buildings have to be supplied in accordance with the particular circumstances. In the plan they consist of several apartments, each of which has its advantages for the accommodation and instruction of the public. Those shown in this plan are of the character usually required for a public horticultural garden: *i.e.*, an exhibition building; an entrance-hall, with all the necessary offices; an aquarium, for the exhibition of fresh- or salt-water flora and fish; and a fernery.

The entrance-hall is most important and necessary for the comfort of visitors, and yet it is far too often a neglected feature. It should be commodious and comfortable for the convenient reception of the public.

The exhibition house should be a sort of conservatory, but always kept as a promenade, its roof festooned with plant life, which can be obtained by the use of the foliage of temperate growing Palms, Acacias, and climbers, and by suspending baskets, which should arch the promenade, and yet not interfere with the ground space, all of which is required for the exhibitions. At every period of the year seasonable flowers should be supplied, either from the plant-houses or by exhibitors, for example, spring flowers, Roses, large banks of stately Camellias, bulbs, and so on.

On the east side of the Exhibition Building are the offices of the establishment, and also the horticultural houses (usually called nursery-houses). Of course these would contain many interesting sights for plant-lovers, and, for that reason, they should be arranged with an entrance from the terrace promenade.

The west end of the building should be occupied as a club-house or café, so that the comforts and necessaries of life may be close at hand. In these buildings museums or collections of art could be formed, as the times might require.

The fernery should be arranged with rocks, in the natural garden style; the walks, edged with a proper proportion of gigantic Tree-ferns, forming Fern avenues, to be over-arched by the monster fronds. These avenues should be planted differently, some distinctive species being used in each, for instance, *Dicksonia squarrosa*, with its black stems, for one; *Cyathea medullaris*, with its silvery effects, for another; and lower growth of appropriate character introduced in each, as space will allow. According to the laws of development, all ferneries should have water effects in the ground design, with rock buildings upon the tableland; rock development is shown in my work "Residential Sites and Environments." The innumerable features thus formed should be planted each with one suitable character: thus, instead of a fernery showing mere pots and labels, it should produce banks of golden Ferns, and, again, other banks of silver; arches of *Adiantum capillus Veneris*; the long, bold fronds—"growing yards of Fern"—dropping from table-rocks, while from the alcoves in the masses of rock an abundance of the clear, green crystals of the filmy Ferns *Todea superba*, "Killarney Fern," &c., should appear. The rock columns might be carpeted with such plants as "Stag's Horns" and varieties of the *Davallia*, and so on. How delightfully charming an *Adiantum* dell would be, and many other species of Ferns, if arranged according to their respective and special characters.

Round Buildings.

The two round, dome-shaped buildings shown on the plan are for special effects; for instance, in exhibiting, Orchids might be displayed in one, Roses in the other, or other special flowers, as circumstances would permit or necessity dictate. Separate apartments are always wanted in showing plant life, as the conditions good for one are not suited to another. The roofs should always be well festooned with climbers; Roses would do for the cool house; *Passiflora* and *Tacsonia* for the other. The ground space should always be kept free, as well as the main buildings, so that they can be used for exhibition purposes.

Back Yards.

The two triangular spaces shown in the plan form the back yards, so necessary for stokeholes and general service. By this arrangement the buildings completely surround the yards, and so make it easy to conceal them, and thus avoid the eyesore that back yards so often become. The connection with these yards, for coals, &c., should be by tunnel from the nursery garden. (See plan.)

Long Views—Mounds.

The long-distance and massing views are seen from the terrace (see plan, Spring Promenade), mounds, and other sites. From the terrace six long views into masses of vegetation are shown, giving impressions far beyond those produced by any mere view of two rows of trees planted in parallel lines. From the terrace also are shown series of flower gardens, shrubs, water scenes, &c. By examining the plan it will be seen that the mounds also give different and largely varied impressions, from the masses of silent life which extend in every direction to meet and satisfy the eye and soul of the true lover of the beauty of Nature. Each change of position will present to an observant eye a different view. There are thousands of variations, yet every garden and plant in the design, though differently arranged, is in strict accordance with natural principles, and thereby produces the impression desired. This great variation should be kept properly united, by the general use of some particular plant in the formation of each scene.

The banks of the mounds should be planted with trees, suited to the surrounding effects, and the ground carpeted with such plants as *Lonicera Halleana*, &c.

Place for Trees.

The 'Cedar of Lebanon' is the plant for the general long view; the 'White Willow' for bordering the island; the 'Hemlock Spruce,' &c., for margins of the big lake; and varieties of Maples and Elms for road shade-trees. It can thus be seen by examining the plan that every effect, however large or small it may be, has allotted to it one suitable plant of permanent character, around which all the varieties, congenial and harmonious, can be placed to advantage. In this way every feature of the ground, from small promontory or recess to the largest of these, can be made a special study. Of course every part of the grounds must be effective—must give not only a succession of special effects during the whole year, but a permanent impression. This can be obtained by the proper use of evergreens, even in the most brilliant effects; they will produce a reality of impression, together with a calmness of repose, thus conveying satisfaction to the senses. No impression is in a complete state whenever or wherever repose is wanting, and an impression that lacks completeness cannot give satisfaction. So, in the small plant arrangement, the perpetual systems explained in my former works are supposed to be adopted.

Trees in Boundaries.

It is very important to have a well-thought-out and artistic scheme of arrangement in order that a kitchen effect shall not be produced in the drawing-room.

Our trees are evergreen or deciduous. The evergreen ones are our natural protectors against cold and climatic changes. Their place is, generally, in the boundaries of our gardens, where they not only give protection and hide away any unsightly objects, but where they also find harmonious and telling places for special effects. Evergreen trees and shrubs are so often neglected in our plantings that I have particularly noted these. A place can be found in this garden, however, for everything that will grow in its climate, deciduous plants as well as evergreen, and all can be shown effectively.

It is ridiculous for the boundary walk of a garden to show a fence line. To avoid this, the boundaries should be made wide enough, and sufficient space allowed for the growth of the more prominent trees, shrubs, and grass, for the full development of their characters, &c., producing park-like effects. In this matter great care is absolutely necessary that too many trees are not planted, for gardens in general are ruined in this way. Trees that require space—say a hundred feet in diameter—usually get about ten feet. As a rule, trees sufficient in number to create a suitable skyline and to develop the general effect are all that is required.

Shrubs are of the greatest importance in garden outlines. They should always be at hand, as they are the chief objects used to hide the limitations, always so troublesome in the boundaries. They are also necessary for the divisions between the parts of the garden in which the different characters of flowers are shown. While the evergreen tree, such as the 'Norway Spruce' or the 'Austrian Pine,' can be used to hide objectionable features, banks of Rhododendrons, Yew, or other shrubs may be quite enough in some parts of the boundaries, where effective scenery is given in the distance beyond the boundaries. From the roadways the foreground planting would show small and large specimen plants or groups of specimen plants, giving to the onlooker a new feature of beauty from every few yards of travel.

The boundaries must be arranged with care, that the general unity of the whole garden be kept intact.

Flower Shows.

Flower shows, during the various seasons of the year, require suitable conveniences. A show of this kind should give pleasure to all, and of course dark, high buildings for plants and narrow pathways, &c., for the public can never give satisfaction. During the winter, early spring, or late autumn the Exhibition Building would be the site for the show.

The Summer Flower Show Grounds are placed on the plan east and west of the terrace, so that easy connection, under canvas, can be made with the building if desired. Exhibition under canvas is by far the best for flowers during the warm period of the year. Two of these grounds are required for a general exhibition in order that seasonable flowers can be

planted and arranged to grow up, in divers places, without their interfering in any way with the exhibits. Thus for the spring shows thousands of Scillas, Crocuses, &c., should be planted in banks and beds, particularly the colours that are likely to be scarce in exhibited plants; for instance, the blue, which is given in such delightful shades by the Scillas. Bulbs in profuse abundance should appear on the exhibition-ground beds, and the grass, likewise, should be richly sprinkled with all the suitable plant life that offers special beauties at that season.

In the Summer Flower Show Grounds the beds should in a similar way be filled with suitable plants, to heighten the general effect of exhibits.

I have numerous plans showing most successful exhibitions, arranged in this garden style, as well as many variations of the other designs, shown in this plan.

Rhododendrons.

The large island shown in the plan is chiefly occupied in the development of Rhododendrons, which would prove one of the features of the year at their flowering season. The dark, rich foliage and the glorious flowers on the Rhododendron ground are developed close to the water and the 'Silver Willows,' and their striking appearance is heightened by the Cedars of Lebanon and columnar Cypresses. The want of gold colour in the Rhododendrons is supplied by a plentiful use of the golden Yew on the miniature promontories of the interior development. This garden should also be planted with thousands of Lily bulbs, as they do well amongst Rhododendrons, and supply flowers when the Rhododendrons are over.

The advantages of placing a Rhododendron ground on an island are several: for instance, when preparations are going on for a big exhibition the Rhododendron ground can be closed without injuring the general garden effect by simply protecting the gates of the bridges. Thus the arrangement of plants, erection of canvas, and whatever else is required, can be accomplished without interfering with the public.

Walks and Promenades.

Pathways are for the convenience of visitors. To lay walks in useless directions, for the mere sake of turning and twisting, is ridiculous. The general walks required should be simple, giving an easy, graceful communication with the various places of interest. Usually this can be attained by a road around the property, and another around or through the centre. Of course this rule may vary, but these two points should be kept in view in arranging grounds. From the two main roadways others branch off to the special effects developed in the garden; and yet other walks, of quite a different character, are often wanted.

Promenades.

A horticultural garden requires promenades as well as walks, that the surrounding beauties of the place may be conveniently and comfortably brought before the eyes of large numbers of visitors. The promenades

should be adapted to every period of the year, and space enough always allowed for both plants and people. Exclusive of the general walks, there are three sorts of promenades necessary to give satisfaction to the public.

The first is shown on the ground-plan of the exhibition house. Being under cover, and so protected against variations in the weather, it can be used at any time, day or night, summer or winter, according to requirements.

The second, or terrace promenade, shown on the plan, follows the outlines of the exhibition house, and is required chiefly for the enjoyment of the public during the delightful months of spring and autumn; this and the first promenade are commonly made straight. By using a simple curve, instead of the straight line, it will be found that great additional enjoyment is gained. The dead or tired impression produced by a monotonous straight path is removed, and a variation introduced much more pleasing to the senses.

In the centre of the garden is the grass promenade. This should have plenty of shade for protection and comfort during the warm summer weather, and should become a veritable paradise of beauty, with its gigantic masses of flowers and encircling fountains. These, as shown in the plan, are seven in number, and the basin of each should contain a different variety of fish and of Water Lily. If desired, one, or even more, might be caged over for an otter, or some such interesting animal, in which case, of course, the Water Lilies and fish would be omitted.

Flower Gardens.

The flower gardens are extensive, and are designed upon the perpetual principle, *i.e.* to be effective during the whole year through, no two figures being quite alike. The balance, proportion, harmony and character are maintained in these figures. Hardy herbaceous plants and others form the chief features for the winter, spring, and late autumn effects, which occupy about two-thirds of the space, in the boundaries of figures. The other third is to be filled with the most brilliant flowers of summer. This principle of arrangement has been greatly admired.

Roses.

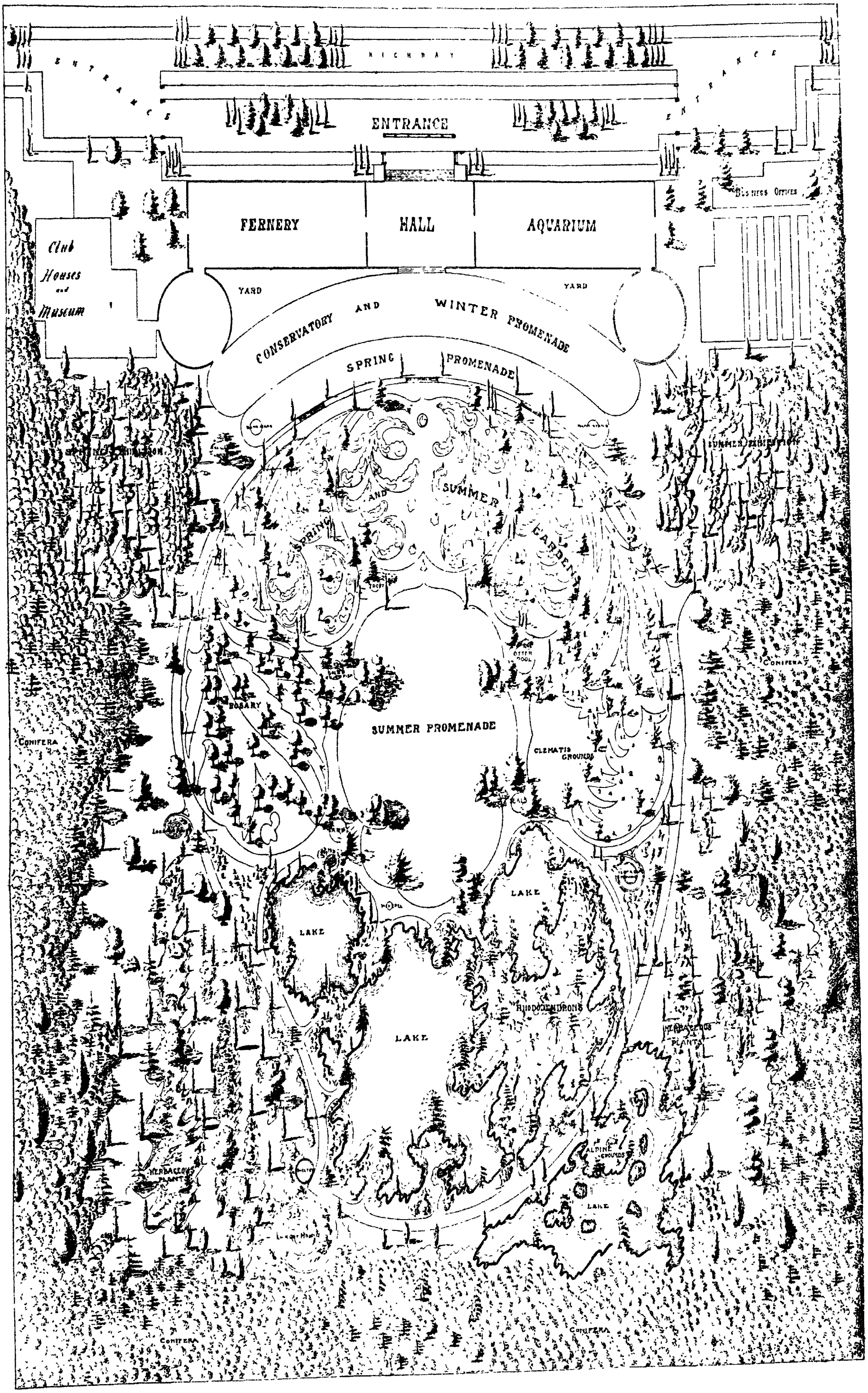
To display their beauties to the greatest advantage the garden for Roses is planned in avenues and groups. The plants in a rosary should cover the ground, and rise in masses of bloom from June until the winter frost to a height of at least twelve feet. This can be accomplished by a proper selection of plants and planting. In arranging supports for the Roses it is better, generally, to plant small growing trees that have not troublesome roots, such as Silver Birch and Lombardy Poplar. Beautiful pillars and arches can be formed from these so as to harmonise with natural scenery. Of course wood and iron supports can occasionally be used to advantage, but a Rose garden should always fill our souls with its gracefulness.

Clematis.

The Clematis can be kept in flower from June until autumn frost, and it would be advantageous to have a garden devoted principally to their

DESIGN FOR HORTICULTURAL GARDEN OF 50 ACRES

SCALE - ONE INCH = 50 FEET



development. The Hawthorn, white and red flowering, and other upright-growing plants can be used for supports.

HERBACEOUS.

The two natural gardens in the low corners of the grounds are for herbaceous plants. The style of formation is better in many ways than the square-line shape usually adopted. It is preferable for a botanical collection, as each figure can be suited, in size and curvature, to the growing of large or small plants, or large or small collections of plants; and the figures arranged to form any sequence desired.

The second herbaceous garden is to be used chiefly for hardy bulbs, for when rare bulbs are grown amongst other plants they are often the losers.

The Alpine or Rock garden, so delightful to everyone who knows it, when placed on an island, as shown in this plan, affords great facility for diversification.

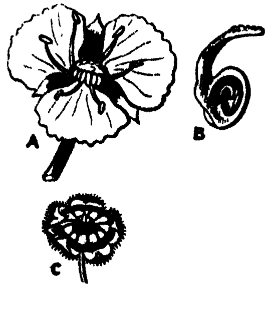
The lowest lake would be a kind of fairy lake, with its seven islands, numerous promontories and recesses, properly developed by planting.

WATER.

Water is necessary in every fully developed landscape. It gives place for beauties far beyond any produced by other diversification of land. The natural character, however, must be maintained. No artificial technical forms, shaped like puddings, milldams, or other mad excrescences, will ever give the infinite beauty of Nature. The landscape artist must know the principles of natural undulations, and he will then find it easy, and not expensive, to lay out water as shown in this plan.

In these notes I have pointed out only the leading features of the plan. By a careful examination, various other effects can readily be seen, and in arranging such a garden very many more can be developed upon the fifty acres. The trees and shrubs in the boundaries rise from grass undulations, large or small, according to the wants of the development; small trees shading the walks give a dark, rich character, full of repose. The gardens of flowers, as shown, are as settings of jewels in the lights and shades of vegetation, and amidst the all-embracing infinities of the sky and water effects.

The work of the landscape artist is like that of the painter in this respect: the fixing of one form or colour properly provides, at once, places for many others.



THE AMERICAN GOOSEBERRY MILDEW IN IRELAND.

By Ernest S. Salmon, F.L.S.

At p. 139 of vol. xxv. of this Journal I gave the particulars of the outbreak, in 1900, at Ballymena, co. Antrim, Ireland, of the American Gooseberry mildew, *Sphærotheca mors-uvæ* (Schwein.), Berk. & Curt. This disease again appeared in the same locality in 1901. I give below the notes supplied to me by the gardener (Mr. J. Nixon, at Whitehall, Ballymena), together with some general observations on the present fungus.

Mr. Nixon wrote: "The disease this year was even more extensive than last; and the young wood seems more affected at this time of year (August) than it did last year. I have not heard of any neighbouring gardens being affected as yet. Some varieties of Gooseberries are far more subject to the disease than others. The 'Large Green' Gooseberry is not affected, while the 'Small Green' is very much affected, although both berries are smooth. The 'Amber' is by far the worst of any. Some varieties of 'Red' seem proof against the fungus, while others are nearly as susceptible as the 'Amber'; the 'Smooth Red' is the worst."

Magnus, from *a priori* reasons, has expressed the opinion that the fungus has been introduced into Ireland from America, and has suggested (1) that imported Gooseberries bearing the fungus may have been the source of infection. This, however, cannot have been the case, as the authorities at the Custom House inform me that no importation of Gooseberries into Britain from the United States occurs. I have learned, however, through Mr. F. M. Moore, A.L.S., of the Royal Botanic Gardens, Glasnevin, that two firms of florists in Ireland imported some years ago Gooseberry plants from the United States. It is certainly possible that by this means the fungus may have been brought over from America. On the other hand, however, we must remember that Ireland possesses some indigenous plants found elsewhere only in North America; also that, as I have already pointed out (2), the fungus known as *Sphærotheca tomentosa* Otth, which is not uncommon on the Continent on several species of *Euphorbia*, appears to be morphologically indistinguishable from *S. mors-uvæ*.

It may be noted here that De Wildeman (3) has lately enumerated *S. mors-uvæ* among the *Erysiphaceæ* of Belgium. The record runs, "Sine loco (Ém. Marchal)." Up to the present I have not been able to obtain any information about this Belgian record.

It may be well here to draw attention to the serious economic danger with which European fruit-farmers will be confronted if the American Gooseberry mildew is allowed to establish itself in Europe. The practical aspect of the subject is ably dealt with by Beach (4) in *Bull.* No. 114 of the New York Agric. Exper. Station, where a full and well-illustrated account of the cultivation of Gooseberries in the United States is given. It is here remarked: "The one great hindrance to the cultivation of

European Gooseberries in this country is their susceptibility to attacks of the mildew, *Sphærotheca mors-uvæ*. From the standpoint of the American fruit-grower Gooseberries fall into two classes, those which suffer from the mildew and those which do not. The former class includes all European varieties and their American-grown seedlings, or, in other words, all varieties of the species *Ribes Grossularia*, L. The latter class includes the cultivated varieties of the native American species *oxyacanthoides*, L., and *Cynosbati*, L., and some hybrids between them and the European species. On account of their liability to serious attacks of mildew, European Gooseberries should not be planted for commercial purposes, except by those who are prepared to contend with that disease."

We may infer from these observations that, if the present fungus were to become widespread in Europe, the whole Gooseberry crop would be seriously affected. I have already, in my previous article, given notes on the best fungicides to use against the disease, and to these the following remarks by Beach on this subject may be added: "Spraying to prevent mildew should begin as soon as the buds begin to unfold, using one ounce of potassium sulphide for every two gallons of water. Repeat the applications at intervals of ten days till the fruit is nearly ready to market. Should frequent heavy rains occur, spray more frequently. Be sure the spray reaches all the foliage, especially on the inner and under parts of the bush, which are usually slighted. The use of Bordeaux mixture is objectionable, because it is apt to stick to the fruit and injure its market value, even though the application be made several weeks before the crop is marketed."

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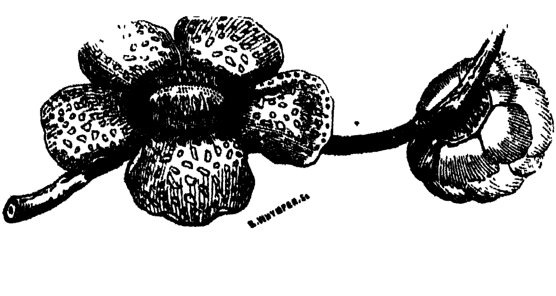


WHOLE FRUIT PRESERVATION—ITS RELATION TO FRUIT PRODUCTION.

By J. E. Austin, F.R.H.S.

[Read November 26, 1901.]

The subject of which I have undertaken to treat relates to an industry as yet in its infancy, but is one which I fully believe to be capable of almost unlimited extension, and which, if properly developed, will have a very important bearing upon the future of the fruit trade of this country. In many respects fruit preservation is so closely allied to fruit production that they may be regarded as one industry, and yet in several important particulars they are distinct and separate; but in any case the success of either must materially affect the other.

The development of the fruit trade of this country, and the rapidly increasing quantities of fruit consumed, make it a subject of great—one might almost say of national—importance. For not only is it the sole source of revenue of many thousands of families, but it has become a very important factor in the food supply of this country. We are essentially a fruit-eating people, and no British table is considered complete, at any time in the year, unless fruit in some form or another is placed upon it. This is a fact which I believe is much more fully recognised by Continental growers than it is by ourselves, if at least one may judge from the vast quantities of fruit imported into this country, and the strenuous efforts which foreigners make to maintain their hold upon our markets.

I believe, however, there has been a general awakening of late years, both among growers and preservers, as to the great possibilities of the fruit trade of this country, and we are beginning to see more clearly than at any previous time that some portion of the large sums of money which are being paid to Continental growers (not only for fresh fruits but also for preserved) should find their way into English pockets instead.

There can be no doubt that the growers of this country labour under a series of disadvantages as compared with the growers on the Continent, and some of them very real drawbacks indeed. Chief among these may be mentioned the fact that, owing to climatic conditions, the growers of the Continent are able to place their productions on our markets some two or three weeks before the same things grown at home can posssibly be ready for market, with the result that the foreign produce is able to make the very high prices which the British public are willing to pay for early fruits; and, at the same time, the keen edge of the public appetite is destroyed or appeased before the fruits of this country are obtainable. This does not, as some may suppose, apply merely to one or two kinds, but to nearly every kind of fruit grown—as, for instance, Strawberries, Cherries, Gages, Apricots, Black and Red Currants, and Plums of all kinds.

Having an intimate acquaintance with Covent Garden and other markets, I have noticed for several years past what fabulous prices have

been made by early arrivals of foreign fruits, in many cases double and treble the prices given for early arrivals of fruits grown at home. Only this season early arrivals of Greengages from the Continent fetched easily 7*s.* to 10*s.* a half sieve of 24 lb., whereas English Greengages, with infinitely more flavour, but coming later, did not realise more than a third of that sum.

The British grower is also heavily handicapped by the railway companies, some of which charge as much, and certainly with much less care and attention, to carry home-grown fruits a few miles as they do to bring the same fruits from France or Holland.

He has also to pay the recognised charges of his commission agent, no matter how flat the market may be, so that not infrequently, after having paid for labour, carriage, and commission, the grower receives absolutely nothing himself for his fruit.

Is it any wonder that the British grower should in some cases become disheartened, or that he should become careless in the cultivation of his fruit crops? Nor is it a matter for surprise that the young men and women of our villages should migrate to the towns, and that our rural districts should become depopulated.

The probability is that this migration will continue until something is done to make it worth while for young people to remain in the country villages, either by reviving old industries and making them profitable or by the establishment of new ones.

Among the many remedies proposed it has frequently been suggested that the waste lands and vacant farms should be brought under fruit cultivation, but this of itself can be of little use unless such undertakings could be made more profitable than fruit-growing has proved during the last few years.

The all-important question is, How is it to be done? My conviction is that the remedy will be found in the direction of finding some new and profitable outlet for our home-grown fruits. Hitherto the British grower has had but two outlets for his produce; unlike Continental growers, he has had no export trade, and has had therefore to confine himself to the open market or to the jam manufacturer. As regards the former, I have already referred to the uncertainty of his return; and as regards the latter, the demand is chiefly for his smaller and later fruits.

Notwithstanding the fact that largely increasing quantities of fruit are required every year for manufacture into jams, and also that the consumption of fruit is rapidly on the increase, the grower has no certain means of disposal for the finer and choicer varieties upon which he has spent most of his time and labour.

To the grower, therefore, the creation of a new outlet for his finest produce would come as a most welcome boon. If it were possible—and I am prepared to show that it is—for the finest fruits of this country (or at any rate those that were not required for immediate consumption) to be preserved whole, in such a way as not to destroy their delicious flavour or colour, and so that they might be obtainable all the year round, it would give the fruit industry of this country an enormous impetus, and place the growers in a better position than at any previous time. Indirectly it would also furnish one of the ways by which the depopulation

of our rural districts might be stayed. And not only is such a consummation desirable in the interests of the growers, but it would also be an equal boon to the public at large.

At present the facts are just these: Lovers of home-grown fruits can have the doubtful pleasure of having too much for three months in the year, and for the remaining nine months (except for Apples and Pears) they are compelled to live on past memories, with the result that they have no alternative but to buy the imported fruits of other countries; whereas, if British fruits were obtainable all the year round—having all the freshness and flavour of recently picked fruit—they would certainly continue to use them in preference to others. I must confess that to me it seems remarkable that until the last two or three years no really serious attempt appears to have been made to meet the evident interest, not only of the growers, but also of the consumers of home-grown fruits.

Preservers seem to have been contented with the continually increasing trade for jam and marmalade, allowing France and America to do the Whole Fruit trade in tins and bottles at very high profits, practically giving them a monopoly in these goods, which they have not failed to use to the very best advantage.

Certain it is that all has not been done that might have been in this direction.

Lest I should be misunderstood, perhaps I ought here to call attention to the fact (which, of course, is well known to everybody) that British-grown fruits have been put up in bottles *in a certain form* for many years past, but with results that cannot be regarded as at all satisfactory. Owing to the long and tedious method of preserving, the flavour, colour, and wholeness of the fruit have been in nearly all cases destroyed. And at no time do such preserved fruits appear to have had any real hold on the fruit-eating public; the fact is, the public wanted something better, something more like what has now been produced by the new method of Whole Fruit preservation.

Some two or three years ago the whole matter received considerable attention; it was generally felt that there must be a departure from the old lines altogether. New "vacuum bottles" were just then put upon the market and were being used for other purposes with some success.

It was hoped that these might be the very thing wanted, and attempts were at once made to utilise them for the preserving of Whole Fruits.

The results were, it is said, by no means encouraging, and in some cases disastrous.

The chief difficulty lay in the fact that a twofold purpose had to be achieved under one operation, viz.: "To perfectly preserve the fruits whole, and at the same time to effectively seal the bottles." This, together with the fact that every kind of fruit had its own special characteristics (requiring different treatment), made it an almost impossible task. Many regarded it as absolutely so, and gave up the attempt altogether. A few, however, persevered, losing a good deal of money in experiments, but having the firm conviction that the principle was right, and that if only the difficulties could be overcome, and it were made possible to preserve fruits *in vacuo*, splendid results would be achieved, and a new era opened in the fruit industry of this country. I need

scarcely say that those difficulties have been overcome; patience and dogged determination have succeeded, and now all the fruits grown in this country, with the solitary exception of Strawberries, are entirely amenable to this process.

As to the distinctive advantages of this vacuum system over all others there is—

First, a great economy of time, the process being very rapid, complete preservation being effected in less than half the time occupied by the old method.

Then, under this system—and this is all-important—the essence of the fruit (and, in the case of stone fruit, of the kernel also) is fully retained (no evaporation taking place), giving the fruits a richness and fulness of flavour altogether unique, and this is so pronounced that users have frequently remarked that essences must have been added to give the fruit so fine a flavour, and would hardly believe it to be natural.

Then, again, the fruits are so completely sterilised under this process that it is believed they will keep a good many years while remaining in bottle; and even when opened they will keep sweet for several days.

And lastly, while in bottle, unopened, they seem to be quite indifferent to extremes of temperature. They have been tested under all conditions of heat and cold, with the result that they remain quite unaffected.

Now, without referring to other advantages which might be mentioned, it may be said, without the slightest fear of contradiction, that this is the most perfect method of fruit preservation yet known, and a method admirably adapted, when understood, to the peculiar characteristics of British-grown fruits. For, as most people know, our home-grown fruits do not lend themselves to the system of evaporation so readily as do the fruits of other countries, but they respond in a remarkably happy way to this vacuum method of preservation.

With regard to the effect which this new method of preserving is likely to have upon our national fruit-growing industry, it is as yet somewhat difficult to speak, for, as I have before explained, the method is still only in its infancy. But if one may judge from the reception which fruits so preserved have met with from the general public, there is very little doubt that a wide door of hope has been opened for the British fruit-grower, and at the same time it has made it possible for consumers to enjoy home-grown fruits all the year round.

There is one fact with which we are all quite familiar, but which does not seem to have impressed us so much as it might have done, and that is that the fruits of this country are not obtainable for more than about one-third of the year. With the exception of Apples and Pears we are practically without home-grown fruit from October to June, during which period consumers have to fall back upon those imported from other countries. I do not refer so much to fresh fruit as to preserved. One would scarcely credit the extent of the trade with the Continent now being done in preserved fruits; it is simply colossal, amounting, I believe, to millions of pounds sterling a year. Why should we not have some share of this spent at home? The reason we have not had it in the past is because there has been no determined effort to grapple with the question—no really serious attempt to preserve fruit whole in such quantities

that the public could obtain it every month of the year. It is not that this is not a fruit-producing country. It is not that our growers are unskilled in fruit culture, and therefore unable to produce really fine fruits. It is not that British-grown fruits are inferior to those of other countries; on the contrary, they are distinctly better. Nor is it that the public do not appreciate them to the fullest extent. The simple fact is that they have not been able to get them.

There has been a missing link; in other words, there has not been until recently any really successful method of Whole Fruit preservation. I have always held, and now more strongly perhaps than at any previous time, that the fruit-preservers are a bigger factor in the fruit industry of this country than is generally thought. The remedy for the ridiculous prices at which home-grown fruits are sometimes sold upon the market during the season, and their almost entire absence for the greater part of the year, is to a large extent in the fruit-preserver's hands. I maintain that his position should be somewhere between the grower and consumer, so as to enable him to link the two together, not for two or three months, but for the whole year. To the grower he should be able to say with confidence and a certain amount of authority, "Bring all your waste land under fruit cultivation; root up your old and useless trees; plant again upon the most approved method young stock of the kinds and varieties suitable for your soil; throw into the operation all the skill and energy of which you are capable; produce the highest-class fruits possible; and then look to us as certain purchasers, at prices which will well repay you for your expenditure of time, labour, and skill." What a sense of relief would come to the grower. No longer need his nights be disturbed with dreams of an overstocked market. No more need he smart under the infliction of the commission agent's inflexible charges. Neither need he remain longer a sufferer through the uncertainties and caprices of the railway companies; but, certain of fair prices and a sure market, he would be able to concentrate all his time and energies upon his honourable calling.

And not only would the grower benefit largely from such a condition of things, but indirectly it would save our village populations, and, to some extent, help to prevent the present serious overcrowding of the towns: it would also prevent the breaking-up of many families. For it is not always correct to say that the young men and young women of rural England are willingly leaving village for town life; in a large number of cases it is simply a matter of compulsion. Give them some profitable village industries and many of them would gladly remain among old associations and friends, and many a moral wreck would thus be averted.

But, further, the preserver should also be in a position to say with equal candour to consumers, "Do not cease your acquaintance with home-grown fruits with the termination of the season. Science has now made it possible for you to enjoy, in all their delicious freshness, these luxuries all the year round. You have simply to place your orders with your fruiterer, grocer, or stores, and you may have, in but a slightly altered form, any British-grown fruits you may desire, at any time—alike in the dark and gloomy days of winter or the freshness of early spring." And I

am confident that such an intimation would be warmly welcomed by all lovers of English fruit. This is not a mere flight of fancy; it is an actual possibility under the new method of vacuum Whole Fruit preserving.

There is yet another aspect of the matter to which I should like to refer. Has it never struck you as singular that—with the exception of jam, and this in limited quantity—there has never been any export trade for British fruits; that, notwithstanding the fact that thousands of tons of fruits are imported into Great Britain from every part of the world in the course of a few months, our export trade for home-grown fruits is practically *nil*? Some few days ago a very excellent article appeared in one of the morning papers—I think the *Daily Mail*—having for its subject "The Timidity of British Manufacturers"; it was altogether well worth reading, and one or two statements appear to bear on this question. It said: "The supremacy of British commerce originally sprang from the fact that her manufacturers were able to supply the whole world with the excess of her own requirements." If that is true —and I do not doubt it—it is very evident that we who are associated with the fruit industry of Great Britain have not been contributors to that supremacy.

There was also another statement equally suggestive: "The serious decline in the exports of this country (and statistics show how serious this is) is largely, if not entirely, due to the fact that her manufacturers are barely able to supply her own requirements." This, too, I believe to be true as regards many British industries, but especially so as regards the fruit industry.

Not only do we not grow sufficient fruit to give us any excess for exportation, but, as a matter of fact, we do not grow more than about half the quantity consumed by our own population. Assuming, for the sake of argument, we *were* able to double our fruit production, and that by some such method as that which I am advocating we could manipulate and effectually preserve it so that it might be proof against any variation of temperature, of heat or of cold, what an important industry it would become! And I can assure you that both the production and the preservation are possible.

I am not forgetting the fact that other countries have a superabundance of fruit; this is doubtless true, but they have not got the kind of fruit which we grow upon our island. British fruits would be just as great a luxury to them as some of their choice kinds are to us. Particularly would this be so in the case of our own countrymen who are to be found in every civilised part of the world, and in an especial sense in that Greater Britain, the immensity of which has been so forcibly brought home to us during the past few months.

Within the past week I have had a conversation with a gentleman who for several years has been resident in Buenos Ayres. Speaking of fruit, he said there was an abundance of certain kinds there, such as Bananas, Pines, Peaches, and Apricots; but such kinds as were grown in England were not obtainable at any price, and although there were 25,000 English-speaking people in that city alone, the fruits of the Mother Country were practically unknown except in the form of jam, and that only from one London firm.

He further expressed the opinion that were it possible to export there (in a form as nearly natural as possible) such fruits as Black and Red Currants, Damsons, Gooseberries, Greengages, Blackberries, and Plums, they would be readily purchased at any price; and what is true of Buenos Ayres is also true of every city and town in the world where Englishmen are to be found.

It will perhaps be asked, Would it ever be possible to place sufficient land under fruit cultivation to produce enough fruit, first to supply all our own home requirements, and then to furnish a reserve for exportation? I shall not attempt to answer that question, as the Fellows of this ancient Society could do this better than I; but it is a matter of common knowledge that there are large tracts of country, many miles in extent, and unoccupied farmsteads in great numbers, which could very well be brought under fruit cultivation.

I have sometimes wondered why some capitalist or syndicate has not attempted to lease the banks and waste lands of our great railway systems for this very purpose.

In direct touch with all the great towns and cities, there would be very little difficulty of transit.

Vegetables are known to thrive and do well in such positions, and why not soft fruits? However that may be, I fully believe that as soon as the demand is created the fruit will be shortly forthcoming.

No argument is needed to convince us of the fact that fruit can be grown in Great Britain in almost unlimited quantity, and of a quality that cannot be equalled, much less surpassed, by any country in the world. And I venture to think that anyone who has seen the exhibits of bottled fruits made here to-day will be convinced that British fruits can be preserved in the highest state of perfection. The one other thing required is an appreciative public, who will buy it in preference to fruits foreign-grown and foreign-preserved. And there is little doubt but that this will come in due course.

As regards the matter of export, that can be left in abeyance until we have an excess above the requirements of our own population. May that day also come!

In closing this paper I should like to say that the statements I have made and the views which I have expressed have been given upon my own responsibility. I have no authority to speak on behalf of the Royal Horticultural Society or of preservers generally. I can, however, claim to have given several years' continuous study to this method of fruit preservation, during which time I have endeavoured to ascertain the peculiar characteristics of every British fruit grown, and to bring them into harmony with this particular system: a task neither easy nor short, as every separate kind of fruit—to be preserved in perfection—requires different treatment. For a long time this involved a great loss both of time and of capital, as experiments always do; but I felt that if the difficulties could be overcome it would be of the greatest help, not only to myself as a preserver, but also to others. One by one the difficulties have been removed, and you will understand the satisfaction with which one is able to say that the seemingly impossible has now become both easy and natural.

The Chairman said: It seems to me that there are many of those amongst the present company who, as amateurs, desire to know how they may best preserve surplus fruit from their own gardens for the supply of their own households. The lecturer feels himself bound not to divulge any trade secrets by telling how his process of bottling is actually done. I am under no such obligation, and having had considerable experience in bottling for the supply of my own household, I will try and explain the process as practised for years with perfect success.

Before the present simple mechanical contrivances were invented for bottling there was considerable trouble and difficulty in forming an air-tight covering to the bottles. This was usually done by tying skins over the neck, or by corking and sealing. These methods were not only slow and tedious, but often resulted in imperfect covering (in which case fermentation and mould must result through the admission of air), or in imperfect sterilising through the bottles not being closed whilst actually at boiling heat. Several varieties of special bottles may now, however, be obtained cheaply from Mr. De Luca and others, with screw tops or simple metal caps pressed over the opening with an indiarubber ring between. (Fig. 334.) The following is the process I have adopted: —

The fruit is gathered before it is over-ripe and put into the bottles without water. The bottles are then stood in an ordinary kitchen oven which is not over-heated, and they are allowed to remain in the oven until the fruit begins to show symptoms of cracking. They are then taken out one bottle at a time, filled up with boiling water, the india-rubber ring placed on the neck and the top immediately screwed on. The tops and rings should be taken out of boiling water to ensure the whole being sterilised. This is the whole of the process. The bottles may then be labelled and stored in a fairly cool place, and if properly done will keep for almost any length of time. Before, however, finally storing it is well to try the tops and, if needful, give an extra screw to thoroughly tighten them after cooling.

The principal varieties of fruit preserved in this way are Black and Red Currants, Gooseberries, Raspberries, Plums, and Cherries.

The subject of the preceding lecture caused such an immense amount of interest, coupled with no little disappointment that definite instructions were not given as to *how* the bottling of the fruit was to be done, that the Secretary of the Society was literally bombarded with letters during the ensuing weeks asking for information. As, therefore, it would not have been fair to Mr. Austin to press him further in the matter, the Secretary asked Mr. De Luca, of 6 Long Lane, Aldersgate Street, E.C., if he would state the system which he follows so successfully, and this he has very kindly done. It is, however, only right to point out that Mr. Austin claims to have discovered a *new* system of bottling, and as it has cost him years of patient labour and experiment, as well as considerable pecuniary outlay, it is only natural for him, and what everybody else in like circumstances would also do, viz., to try to keep the secret to himself until he has been able to recoup his initial expenditure and establish a connection. What the novel element in his

system may be cannot at present be discussed, because it is not known to anyone, and when it is made public opinions will probably differ as to its claim to the term *new*; but about the excellence of its results there can be no two opinions, for not only did his exhibit *look* most inviting, but we can testify from actual experiment that the fruits were quite as excellent in use and flavour as they were in appearance.

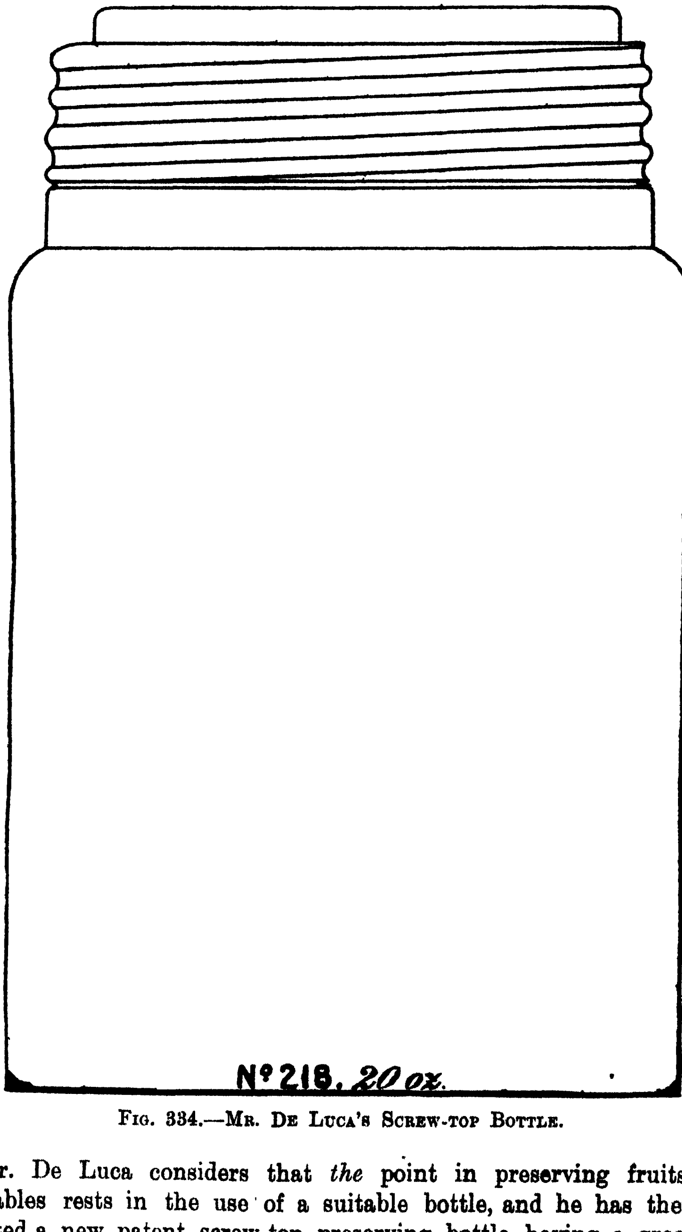


FIG. 334.—MR. DE LUCA'S SCREW-TOP BOTTLE.

Mr. De Luca considers that *the* point in preserving fruits and vegetables rests in the use of a suitable bottle, and he has therefore invented a new patent screw-top preserving bottle having a groove in the neck to hold an indiarubber ring on which the lid of the bottle rests, being kept in place by an outer screwed metal ring fitting on to

the thread upon the neck. It requires no clips or further apparatus to keep the lid on. (Fig. 334.)

Mr. De Luca then goes on to say: Select sound, ripe fruit, and pack it as closely as can be done without bruising up to the shoulder of the bottle. Pour in cold water, or rather thin cold syrup (of the strength of one tablespoonful of best crystallised cane sugar to the pint), just sufficient to cover the fruit. Next adjust the indiarubber ring in the groove on the neck of the bottle, place the disc upon it, and *lightly* screw down the outer ring, but not so tightly as to prevent the escape of the steam. Stand the bottles in a boiling-pan, which should be filled with cold water up to the shoulder. The time necessary for boiling varies with the different fruits. After boiling the necessary time, take the bottles out one by one, holding each in the left hand with a cloth, and *at once* screw down the outer ring as tightly as possible. The next day they should be examined by unscrewing the outer ring, and trying whether the disc is firmly fastened down. If so, replace the ring, screw down tightly, and store away, standing the bottles upright, so as to keep the contents from contact with the metal disc and indiarubber band. The bottles, discs, and outer rings can be used over and over again, but it is better to have new indiarubber bands each time. The bottles are made of various sizes and of various shapes, with wide or narrow mouth.

The length of time to boil each kind of fruit is a matter of experience, but a celebrated French chef gives the following:—Tomatos, thirty minutes; Currants and Cherries and Gooseberries, twenty minutes; Plums, twenty-five; and for Strawberries he says: Select perfectly sound ones, and drop them into boiling water for a few seconds before packing them gently in the bottles. Boil for fifteen minutes.

[We should have thought from our own experience that the length of time given above for the bottles to be kept in the *boiling* water was too long. As a matter of fact, we are daily using in this month of March Black Currants, Raspberries, Plums, Damsons, Apples, and, perhaps best of all, Pears, which we bottled last summer in the manner described by Mr. De Luca, but which were only left fifteen minutes on the fire after once the water in the boiling-pan began to boil. In passing we may say that we find no Pear so good for bottling purposes as 'Pitmaston Duchess,' and we use them just before they would be considered quite ripe enough for dessert. For dessert, in our opinion, 'Pitmaston Duchess' is not worth eating—it is almost nasty - but bottled it is delicious.

A more elaborate and scientific method of bottling is described in detail in vol. xxv. p. 364. The reader is advised to consult this, as it also contains illustrations of Messrs. Lee's admirable boiling-pan.—ED.]

FORESTS, ARBOR DAYS, AND MANURING FOREST TREES.

By F. E. H. W. Krichauff, Corr. M.R.H.S.

If the opinion of Herr Reichert, of Berlin, is correct, that Great Britain is almost at the bottom of the return giving the proportion of forest land to the total area, viz., 11,272 square kilometres, I think it is time that public interest should be aroused in the matter of forest-tree planting. The return alluded to gives to Russia and Sweden forests equal to 42 per cent. of their area, to Austria 31, to Germany 26, to Norway and India 25, to France 16, to Portugal 5, to Great Britain and Ireland 4, and to Cape Colony 0·29. Parts of Siberia, South America, and Central Africa remain the chief sources of supply for the near future. In France the alarm was given not long ago by M. Melard, and M. Guinier, an inspector of forests, believes that the planting of forests in France is now full of promise. England wants to save Egypt from ruin, perhaps never to leave it again; but what says another inspector of forests, M. Roger Ducamp? "If the *pax Britannica* in Egypt means the drying up of the Nile, such a peace is worse than anarchy"; and Lord Rosebery once said, "The Nile is Egypt, and Egypt is the Nile," whose sources are constantly decreasing in consequence of the destruction of the forests there. Without forests, little water; without water, no crops, no cattle, and rent and taxes cannot be paid.

Of course Great Britain has an insular and a moist climate (exactly what is wanted for forests), and has coal possibly sufficient for centuries, and therefore does not require firewood; but it is quite different when we have to deal with the question of timber, of which from 12 to 14 cubic feet a head are annually used, although iron is more and more taking its place in ships and house-building. Yet Dr. W. Idelich, a forest expert, in an address delivered before the Society of Arts, predicted in spite of this a positive timber famine in the near future, and concluded by saying, "That country that first engages in systematic timber cultivation on a large scale will do much to assure its own perpetuity as a nation," and in my opinion as a wealthy nation also. Take Palestine and Spain as instances of the gradual simultaneous decline of forests and prosperity. Take the King of Greece and Princess Sophia on the other hand, who on their own estates and at their own expense are planting forests, so convinced are they that the gradual deforesting of the kingdom is leading to disaster. The ratio of timber consumption in Europe is constantly increasing. It is said that Germany needs 30 cubic feet a head, and that the natural growth cannot keep pace with the demand, especially for soft woods, is shown by the news that the limit of production has been reached in Scandinavia, and that they are now awakening to the fact in Sweden, so that the school children planted last year on Arbor Day no fewer than 600,000 trees. Canada can still export, although many districts are already depleted; but the United States—where private owners are now largely planting (and Nebraska has now a billion of forest trees growing on land which in former

geographies was noted as the "Great American Desert" from their total absence)—have against this an annual consumption of 350 cubic feet a head, or 25,000,000,000 cubic feet, for fuel and lumber. The United States now use the annual growth of 1,200 million acres of woodland, whereas the total forest area is less than 500,000,000 acres, so that more than half of the annual consumption is a draft upon forest capital. Without regarding street or suburban traffic, 90,000,000 railway sleepers are annually required for renewals at 25 per cent. advance on the price of ten years ago, and 600,000 telegraph poles at 50 per cent. advance. Mr. N. A. Eggleston, of the United States Department of Agriculture, actually states, "Lumber alone would load a train of cars sufficient to encircle the earth at the Equator, and, if we add all other timber, posts and fuel, such a train would be 100,000 miles in length; or it would require 480,000 ships of 1,000 tons each to load the forest products." According to his calculations the commercial value of the forest trees of the United States is so great that it exceeds that from any other source. In 1894 the value of the cereal crops was £208,601,589, whilst that of the products of the forests for that year was £3,000,000 in excess; the value of the gold and silver raised was only one fifteenth, and the whole value of all mineral products was only about one-half of the forest products. Such official statements are bound to arouse public attention!

Great Britain was well provided by nature with great forests. The Druids had their fine groves of Oaks, and Queen Elizabeth was amongst the first English-speaking advocates of forestry. Comparatively few of these Oaks remain; but according to the best authorities they may live 1,500 years—only Cedar, *Sequoia*, and Baobab having a still longer life, while Poplars reach only 50, Elms 335, Maples 516, Birches 576, Oranges 620, Cypresses, Walnuts, and Olives 800, Planes 1,000, and Limes 1,100 years. Had former generations no duty to posterity? They had only a life estate in the forests, with no permission to waste; and as far as possible the present generation should try to rectify this great injury to the British commonwealth by planting largely. New Zealand has done this; and South Australia, at least for some time, paid a bonus for successful plantations of forest trees, and distributed them free of charge. Cannot wealthy Great Britain follow the example of Germany in raising forest trees at cost price for municipalities, and paying a bonus of ten shillings an acre for forests planted by them, or (with some restrictions) to private persons who will do the same? There are in fact townships in Germany where they require no district taxation. At Freudenstadt, for instance, they have been since 1875 in the enviable position of being able to pay to each of about 1,300 burghers a sum varying from 25*s*. to 55*s*. from the profits of the forest owned by the little town. Another instance is Saaldorf, where the eighty-four ratepayers each receive every year wood and turf for burning to the value of £5, and lately the sum of £880 was divided amongst them, or nearly £10 to each, as surplus from sales of timber. This village had yet a further sum of £3,000 in hand, and, of course, no debts. The initiation of such a system by the Government seems to me a *sine qua non* for success, at least with the smaller landholders. Even so long ago as April 1863 the Secretary of State for India wrote to the Governor of Madras: "To

forests, from their nature, the usual maxim of political economy, which leaves such undertakings to private enterprise, cannot be applied. Their vast extent, the long time that a tree takes to reach maturity, and the consequence that few persons live long enough to obtain any, and more especially the highest, returns for expenditure, even once in the course of their lives, are proofs of the necessity that forest management should be conducted on permanent principles, and not left to the negligence, avarice, or caprice of individuals, and therefore point to the State as the proper administrator, bound to take care that, in supplying the wants of the present generation, there is no reckless waste, no needless forestalling of the supply of future generations. This is matter of experience, not in India only, but in all parts of the world."

The number of State forests in Great Britain is very limited, and I presume there are not many Crown lands that could be forested; but if the large landowners have not already set the example, they should do so without delay. I wish also to ask whether much notice has been taken by the Government of the letter which Sir Joseph Hooker addressed in October 1873 to the Colonial Office: "The duty of conserving the natural resources of the Colonies [here referring to the destruction of forests] for the benefit of future generations is becoming the most pressing and arduous duty of those entrusted with the government." And what he advised for the Colonies, has it been acted upon at least in some degree at home?

The question is always asked whether forests will pay. I can only say that Herr Gustav Wegener, Councillor of Forests, of Coburg, in advocating a term of eighty years for the cutting of Pine forests, calculates to receive from medium soil a yearly revenue of from 3 to 5 per cent. on the value of the land. With Beech forests it will be about the same; but the timber of Oaks, requiring from 120 to 160 years before being felled, is constantly rising in value, and the State is in future only going to plant Oak for timber, and not for firewood.

I have always advocated Arbor Days since in 1882 I passed through the west of the United States, and noticed the alteration they have made in the appearance of these formerly treeless regions. Whether these are or can be introduced with advantage in Great Britain I am unable to say; but if so they might within a short time become a most enjoyable holiday for the whole neighbourhood. I presume there are not many schools with an area of five acres—the smallest area recommended in the United States. But if there is any available land for planting in any neighbourhood the children of the school or schools, although taking part in the planting, need not prevent grown-up persons from planting also, and thus make it a general holiday, as sketched by Mr. H. S. Sterling Morton, who established Arbor Days in the United States, when he said in 1887 at the State University of Nebraska, "Ordinary holidays are retrospective in honour of something good or great, but Arbor Day is not like other holidays; it sketches outlines, establishes the useful and beautiful of ages yet to come, etches upon our prairies and plains gigantic groves and towering forests of waving trees, whose beauty will compel the admiration and gratitude of men and women yet unborn. It is the sole holiday of the human family which looks forward and not backward." Cannot

horticultural societies offer premiums to the men who properly plant the greatest number of trees during the next three years, or at any District Arbor Day? And would not such Arbor Days soon be welcomed with as much zest and enjoyment as they are now in most of the United States (and here in South Australia), even where there is no great scarcity of trees in the neighbourhood? Each year larger and larger numbers interested in previous plantations, which may be near or adjoining that to be planted, will meet there and enjoy both this meeting with old school-fellows, and also be pleased with the growth of the trees they had formerly assisted in planting.

To encourage the best growth, it seems to me not out of place now to refer to manuring. Only quite lately Belgium, Denmark, and Germany have commenced to fertilise the land upon which forests are to be planted, or even established forests. Formerly nursery plots for forest trees were usually manured with dung, but in 1869 Peruvian guano was first applied and soon afterwards other commercial manures. It was not, however, till 1880 that this became at all general. Photographs taken of young trees of the same age have convinced me that the increased number and size of the roots produced in fertilised nurseries gives them a better chance when transplanted, and Dr. Smets states in his pamphlet, "La Culture du Pin Sylvestre en Campine," that "if you sow Pines, as so often is done, in a nursery with impoverished soil, you can only obtain sickly plants, which will have little chance of success." M. Martinet also says: "It is a wrong idea that young seedlings should be acclimatised and made hardier, so that, if intended for poor soil, they may be satisfied with the local conditions. Pines one or two years old take out of the soil from 24 to 28 lb. of potash, 20 to 24 lb. of phosphoric acid, 60 to 64 lb. of lime, 16 to 20 lb. of magnesia, and 56 to 64 lb. of nitrogen per acre, so that it is an undoubted fact that after the removal of the seedlings from the seed-beds the soil is so impoverished that mere stable dung and green manuring is not sufficient to again raise strong seedlings from beds which must of necessity be used again and again."

Dr. Giersberg, of Berlin, from whom I take the particulars as to the manuring, recommends for nurseries the use of from 640 to 800 lb. of Thomas phosphate and the same quantity of kainit, the latter to be applied long before the sowing of the seeds for green manuring. The crop should be ploughed in when in full bloom and the first pods are formed. Without green manuring, nitrate of soda should be applied between the rows in one or two doses, according to the quantity which seems necessary, from 80 to 160 lb. Dr. Giersberg also thinks it advisable to put a portion of the Thomas phosphate into the subsoil, and the rest, before or after sowing or planting, into or on the surface soil. In nurseries on peaty soils in Denmark and in Schleswig-Holstein the ground is dug at least 18 inches deep in autumn, and then receives 640 lb. of kainit and 400 lb. of Thomas phosphate of 17 per cent. per acre. In May 200 lb. of Lupines are sown and ploughed under as before mentioned, with 1,200 lb. kainit and 800 lb. Thomas phosphate again applied. This may seem too much, but when actually 3,200 lb. of each were applied the seedlings throve well and were certainly not damaged. Frequently up to 160 lb. of nitrate of soda is given later on, and even a second dose.

Belgium seems to be in advance of all other countries in the use of large quantities of fertilisers for forests. Sixteen to 18 inches is the usual depth of ploughing there before planting, and if a subsoil plough can be used 2 feet 4 inches to 2 feet 6 inches is not unusual. Large tracts of waste lands are thus planted and fertilised, and to do so at the smallest expense Rye and other crops are raised for some years between the rows of the young trees. Green manuring mostly consists of Lupines, which will penetrate even hard and pebbly soils to a depth of 8 feet, and thus permit the moisture to rise, by means of the openings left by their dead roots, for the benefit of the trees. Liming is also used, or in very sandy soil marling is preferable. Potash and phosphoric acid are added to improve the surface soil, which, when thus treated, is expected to keep the trees in good health and growth for ten to fifteen years, after which time the roots are likely to find sufficient nourishment in the deeper subsoil. Where green manuring with Peas was used on a sandy soil of the eighth class, a good crop gave no less than 180 lb. of nitrogen per acre, equal to about 1,150 lb. of nitrate of soda. Prof. Dr. Goetting used in one instance 640 lb. of Thomas phosphate and also of kainit; in another twice as much; and Dr. Dalgas, of the Association for Planting Danish Heath-lands, actually recommends five to ten times as much potash, and four to six times as much phosphoric acid.

That it will pay to use fertilisers for forests can hardly be doubted. The experiments, at least, are very encouraging, but more time must elapse to decide whether any further fertilisers are required, whenever, for instance, Pines show at a certain age a stoppage in their growth. Prof. Dr. Wohltmann, after many experiments, declares that in most instances large stores of mineral fertilisers are to be found in the deeper subsoils, and thinks more manuring unnecessary. It is ascertained that 1 lb. of nitrogen is sufficient to produce from 125 to 200 lb. of dry wood, 1 lb. of potash up to 3,300 lb., and 1 lb. of phosphoric acid up to 5,000 lb. Whenever fertilisers are given to single seedlings or to larger trees, they should not be used in larger quantities, nor without being well mixed with the soil. From 1 to 2 oz. of Thomas phosphate, ½ to 1 oz. of 40 per cent. kainit, and ⅓ to ½ oz. of nitrate of soda may be sufficient, the last to be repeated the following year. In Eberswalde, in a forest of seventy-year-old Pines in poor condition, 800 lb. of both Thomas phosphate and kainit and 160 lb. nitrate of soda per acre were used. At Hadamar, Oaks eighty years old have been felled, and Pines sown amongst the stumps with the same quantity of fertilisers. The stumps showed shoots as much as 6 feet long, while on unmanured land these were only 2 to 3 feet long. Fifteen-year-old Pines in miserable condition, only 1 foot 8 inches high, and making only 2-inch shoots annually, were three years ago mulched with horse-dung. In the very first year they showed a fine green colour, and the average annual shoots made since are more than a foot long. Mulching with potato haulm or other material gave not quite so good a result. The annual shoots averaged 8 inches; the nourishing constituents in the dung caused, therefore, the growth of the extra 4 inches.

ARBOR DAY.

By E. D. Till, F.R.H.S.

"Forward in the name of God! graffe, set, plant and nourish up trees in every corner of your grounds; the labour is small, the cost is nothing, the commoditie is great, your selves shall have plenty, the poore shall have somewhat in time of want to relieve their necessitie, and God shall reward your good mindes and diligence."

John Gerharde, 1633.

Trees are more or less common to the whole surface of our land, whether marsh, moorland or mountain, arable or pasture, arable land, perhaps, excepted, but even arable fields are often skirted by trees. There are few altitudes in the British Isles where trees will not flourish. We speak of trees "clothing" the earth, and when they are absent we speak of the "naked" landscape, as though that which was proper to it was wanting. Trees, therefore, are the earth's natural ornament, and it is *un*natural for the land to be without them; moreover they are necessary, because trees, and vegetation generally, consume the waste products of animal life; thus they play an indispensable part in the economy of nature.

The carbon dioxide exhaled by animals is inhaled and assimilated by plants, and this is one of the marvellous processes which are a continual witness to Creative design. The silent machinery is ever in motion by which the atmosphere of our planet is purified, and the processes of animal life find their counterpoise in the processes of vegetable life, the one complementary and necessary to the other by a mutually operative and immutable law. Were it otherwise, both plants and animals would be poisoned by the respective waste products they exhale.

Treeless areas are not conducive to the retention of moisture; the rain that falls on them either flows away quickly because it meets with no impediment or is rapidly evaporated, whereas forest lands, rendered porous by the roots which permeate the soil, and shaded by foliage, are far more retentive.

Therefore every tree that is planted contributes to the conservation of water, restrains the denudation of the soil by floods, tempers and improves the climate, enhances the beauty of the landscape, and assists, above all, to provide for the constant need of every community in the supply of timber for constructive purposes and for fuel, as well as in bringing forth abundant fruits for man's enjoyment. Nothing tends so much as trees to make the earth a pleasant abode for man. In former days, particularly in North America, the vast expanse of wood was an impediment to the progress of agriculture, and the clearance of the forest for the purposes of cultivation became a prime necessity. But the axe was laid at the roots of the trees with a vengeance, and the forests were felled without any regard to the future; present necessity was the sole thought in the minds of the early settlers, and they, like multitudes who came after them, "held the cent so close to their eye as to obscure the dollar beyond"! Forest fires, kindled by accident or carelessness, followed in the train of destruction, until in process of time thoughtful and far-seeing

citizens foresaw that the supply of timber would be inadequate, and viewed the rapid depletion of the trees with alarm. Measures of conservation were then devised. A pioneer settler, the Hon. J. Sterling Morton, in the treeless plains of Nebraska, suggested the inauguration of an annual Arbor or Tree-planting day, and eventually stimulated the popular feeling in the right direction. The response was general; the first observance in Nebraska State was in 1872, and the first Arbor Day holiday occurred on April 22 of that year.

Other States and Territories followed this example—Tennessee, for instance, in 1878—until at the present time nearly every State in the Union has established the regular observance of Arbor Day as a public institution, Delaware, Indian Territory, and Utah being the only exceptions. It is said that in South Carolina a whole week is devoted to tree-planting. Nebraska, once called the Great American desert, is now significantly styled the "Tree-planters' State."

Up to 1896 it was computed that the planting of 605,000,000 trees in Nebraska was directly traceable to the Arbor Day movement, and so extensively has the custom prevailed throughout the whole of the United States that it is impossible to estimate the number of trees planted through Arbor celebrations. From the first the idea was to enlist the interest of children in the work, and with such success has this been done that the school authorities throughout the States have been made the chief agents for the promotion of the national observance of Arbor Day, which is always associated with the idea of a public holiday. Each State of the Union has its own Arbor Day: some observe it in November and December, others in January and February. In Nebraska it falls as late as April, and in North Dakota as late as May 6. Washington's birthday, February 22, is the date of its observance in Texas.

Americans consider the custom conducive in a high degree to juvenile education, cultivating in the young the love of Nature and the observance and interpretation of her wonderful laws. For instance, the systematic care and attention to detail called forth by the planting and nurture of even one tree, and watching its growth and development, cannot be without formative effect on character. Probably the introduction of youthful energies into the scheme in large measure accounts for the marvellous success of the movement. Visitors to the United States and Canada, where the custom also prevails, return home impressed with its advantages.

Australia, New Zealand, and to a partial extent South Africa have adopted the Arbor Day custom. Tasmania has not yet felt the necessity for it, but she would do well, possessing as she does so much virgin forest, to be wise in time. Italy and Spain have endeavoured to introduce the movement, assisted by royal patronage in each country.

Except in the Kentish village of Eynsford, the custom has not been celebrated in the British Isles. Arbor celebration was begun in Eynsford in the Jubilee of 1897, when farmers and cottagers planted Apple-trees and the school children planted a row of trees on the school bank, arranged so that the initial letters of the name of each tree spell a text of Scripture. The successful defence of Kimberley, Ladysmith, and Mafeking was commemorated by the planting of trees

in the village street in 1900, and this year thirty trees have been planted in memory of our beloved Queen Victoria, representing Tennyson's celebrated line, "She wrought her people lasting good."

The origin of Arbor Day custom at Eynsford was due to the gratuitous

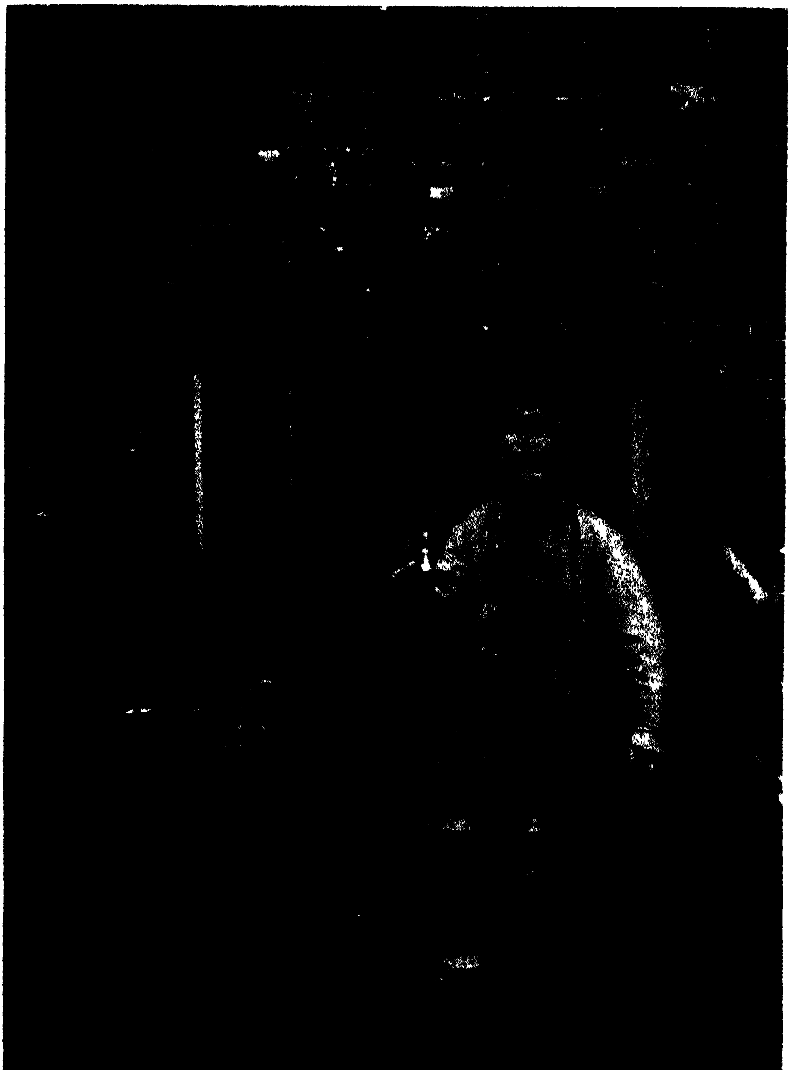


FIG. 335.—WILLIAM HOWARD OF EYNSFORD.

offers of Apple-trees for orchard renewal by the late Mr. W. H. Cullingford, of Tunbridge Wells. His objection to bestow trees for allotments on the ground of uncertain tenure led to the discovery that a cottager named William Howard (fig. 335) had planted a "Winter Queening" Apple-tree in his allotment in 1889 and had held that allotment continuously for

fifty-eight years. The circumstance was noticed in a letter to the *Times* in January 1897, and the same letter suggested an Arbor Day for orchard renewal. Howard, since deceased, on the presentation to him of a testimonial, admirably summarised cause and effect by the trite sentence:

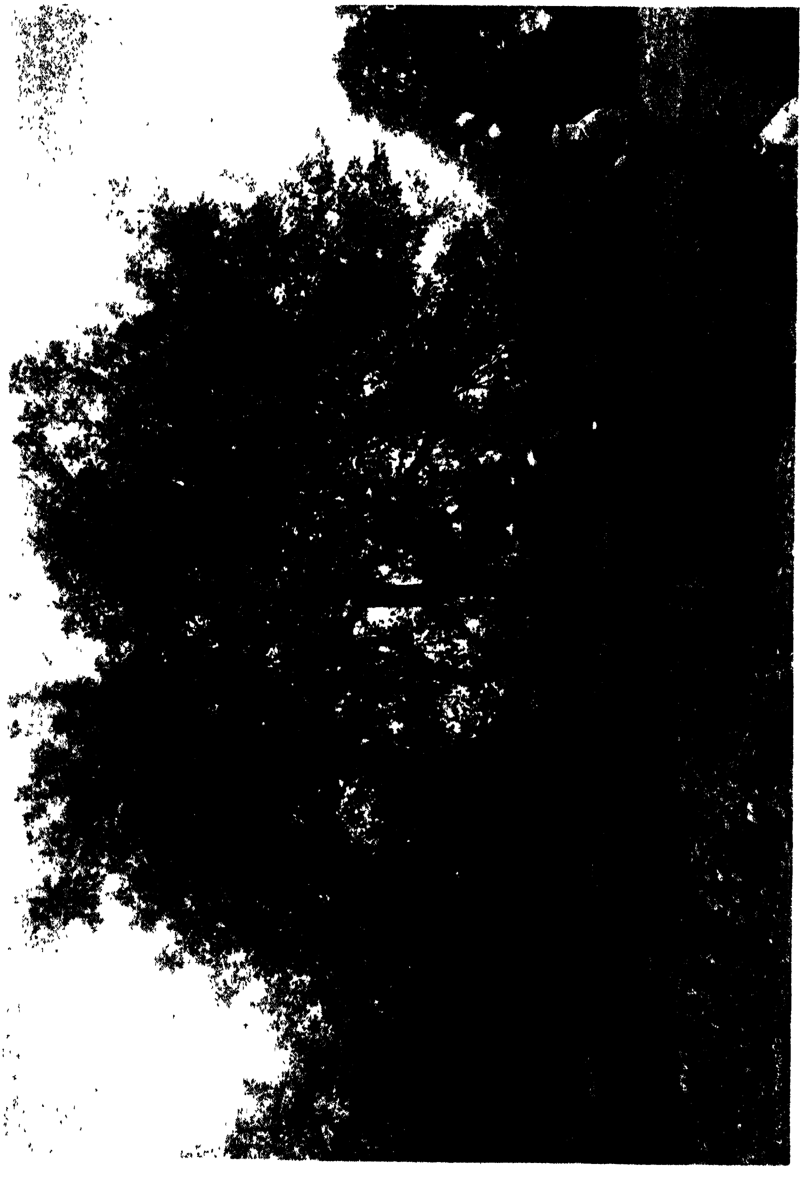


FIG. 336.—WILLIAM HOWARD'S 'WINTER QUEENING.'

"If I hadn't planted that *there* tree I shouldn't have had all this *here* fruit!" In 1895 he gathered thirteen bushels from his Apple-tree, which is a fine specimen, with a trunk 4 feet in circumference and still in its prime. (Fig. 336.)

The forces that operated for Arbor Day in the United States are less existent in this country, for there the value of timber annually used and exported exceeds the value of the cereal crop. Here we are so largely dependent on foreign supply that we do not feel the necessity for planting, but we ought to remember that the countries from which we draw our supplies are themselves alarmed at the prospect of forest depletion. There are nevertheless the strongest arguments for extensive planting of timber-trees in our own land, in Ireland particularly, but only the strongest advocacy will secure proper attention to the question.

Agricultural depression has led to serious social changes in our rural districts, bringing about a system of disintegration. Old bonds have been broken; the exodus to the towns has weakened the local tie, that is to say, the love of locality; and high rents with bad housing accentuate the mischief. In many parts there no longer exists as formerly among the labouring population the old affection for rural life and surroundings, and the absence of this sentiment offers obstacles to the enlistment of interest in Arbor Day observance among the rural population.

The great evil which afflicts country districts within twenty or thirty miles of London and of other populous centres is the housing of the rural labourers under town conditions, for they are in fact housed as badly and almost as extravagantly in regard to rent as where population is dense and land is dear. Unoccupied land is everywhere abundant which can never have much more than an agricultural value, and on which thousands of families could enjoy all the privileges that should be the birthright of country-born children. But many landowners make housing in the country far more difficult than it is in towns, and this pernicious policy intensifies the evils of rural depopulation, which is virtually rural degeneration. An urban system of housing in blocks without gardens obliterates the attractive features of the rural landscape and degrades the rustic population. The rehabilitation of the cottager on the soil more than anything else would revive the spirit of country life. Cheap housing on ample plots where the pigs, the poultry, the hutches, and the hives largely contribute to the rent would render cottager industries again possible; moreover, a feasible scheme of endowment life assurance would put many a thrifty labourer in possession of his freehold. The rural housing problem really underlies the rural education problem, and all rural educational reforms must fail of their effect until the rural labouring population is housed under conditions natural to country life.

A satirical poet in the time of James I. reproved the prodigality of the rich when he said—

> They wore a farm in shoestrings edged with gold,
> And spangled garters worth a copyhold.

Unhappily, many a labouring man in the course of a few years spends more on hurtful self-indulgence than would secure him a freehold house and land in middle age. A trifle over one shilling a week at the age of twenty-five will secure £100 at fifty-five, or at death if previous; if commenced later in life the premium is, of course, proportionately higher. The furtherance of freeholding for our rural dwellers would furnish Arbor Day with votaries and at the same time really inculcate the

principle of old age pension, but the tenant system is eating out the heart of country life, and until there is reform it is doubtful whether Arbor Day will prosper in our land as it does across the Atlantic.

One most profitable direction for the Arbor Day movement would consist in the multiplication of orchard trees, and particularly by cottagers in their holdings, but uncertainty of tenure and the lack of garden ground check fruit culture by labouring men. This is peculiarly unfortunate, because fruit cultivation is profitable. Freeholding would of course be the true remedy for this state of things, and at once stimulate the cottager to plant for profit; but nevertheless there is one means of meeting the difficulty, that of cultivating fruit trees in tubs. The trees would then be removable or marketable should the tenant change his residence, and it may be almost taken for granted that a fruitful tree would be too precious to part with.

The Arbor movement has possibilities in many directions. Individual effort might accomplish much in providing shade trees in our streets. There is an example in a South Coast town of this, where a resident planted a row of Limes, in 1875, on the southern side of the Chichester Road, Bognor. They are now 27 feet high, with stems 44 inches in circumference, materially enhancing the value of adjacent property. The planter has tended them continuously for twenty-seven years, and from first to last with his own hands.

Why should not many who live in cities and possess some little means follow the example of the late Sir Joseph Prestwich, who, when comparatively young, bought and planted a plot of land where in after years he built his house, thus exemplifying the passage "Prepare thy work without, and make it fit for thyself in the field; and afterwards build thine house" (Prov. xxiv. 27)?

We in England owe much to our predecessors, and it is certain that the planting of timber-trees is not keeping pace with the rate at which our heritage is disappearing. The up-keep of our national heritage is a duty devolving on all, and we can only discharge the debt we owe to our forerunners by planting vigorously so as to earn the thanks of posterity. We have not ourselves planted what we now enjoy. We can but say, "Other men laboured, and we have entered into their labours."

Planting may take many forms. How noble our avenues—or "advenues," as the word was formerly written, doubtless originated in the clearing of an approach to a house in a wood; but they were afterwards artificially formed by planting. The Spanish Chestnut Avenue at Easebourne, near Midhurst, the noble arcades at Bushey Park and Hampton Court, the avenues at Windsor, at Ashridge, and at Cassiobury * have conferred untold enjoyment on many generations. But are we creating a similar heritage for our successors?

* The noble Limes in Cassiobury Park were raised at the other Hertfordshire seat of the Earl of Essex, at Hadham Hall. His gardener, Moses Cook, speaking of the Lime trees to be planted at Cassiobury, says in his book: "In November 1672 I had the trees at Hadham Hall nursery taken up as carefully as I could, with good help, and carried them to Cassioberry, the place of their new abode." Lord Arthur Capel, Baron of Hadham, was beheaded at Colchester 1648, and buried at Little Hadham. His son Arthur, born 1636, was created Earl of Essex 1661, and had his estates restored to him. Moses Cook was his gardener. It was this Earl who planted the Cassiobury Lime Avenue.

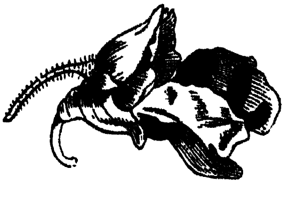
There are noble examples of ancient Oaks with celebrated histories, notably the Cawthorpe Oak near Wetherby, supposed to be the oldest in the land. Wm. Burgh's drawing of it is published in Dr. Hunter's 1776 edition of Evelyn's "Silva." Its trunk then was 26 yards in circumference at the base, and 16 yards 3 feet from ground. Its limbs stood outwards 50 feet all round; 500 cattle could shelter under its branches, although it was then decaying! It is still alive but prostrate, fenced round and supported with commendable care. This ancient Oak might have been cradled in the acorn when Cæsar invaded our island.

There are also topiary examples of ancient form. John Evelyn, on March 25, 1664, wrote in his "Diary" of pretty hedges of Alaternus, having a "skreene of exceeding height accurately cutt on topiary worke." But "topiary" is not suited to all tastes; some gardeners inveigh against it; but, like Madame Guyon, we should learn "to die to our aversions"! Topiary has its place, but ought to be kept within bounds. Mazes were an old-world conceit. There is a very promising example in Yew, perhaps twelve years old, at Shoreham Place, Sevenoaks, indentical in plan with the well-known labyrinth at Hampton Court. It is doubtful whether the "mazes" mentioned by Shakespeare were arboreal examples.

But the Arbor question is a wide subject and expands as one advances, I shall conclude by reminding Fellows that a pathetic instance of memorial planting associates our late beloved Queen Victoria and the Prince Consort with our Society. Near the Mausoleum at Frogmore are two handsome Wellingtonias, originally planted in what were formerly the Society's Gardens at South Kensington - one by the Prince Consort, President of the Society, on June 5, and the other by Queen Victoria on June 24, 1861, the year of the Prince's death. They were removed to Frogmore on December 15, 1869, and on the 17th were replanted by Her Majesty near the Prince's Mausoleum. One of the trees died in August 1870, and another was planted in its place by the Queen in December of the same year.

Throughout her whole life our beloved Sovereign was a persistent tree-planter, and there is no more fitting way of keeping her endearing memory green than by her people following her Royal example, and for ever commemorating the close of her loving reign by an Arbor Day on January 22—the day on which she entered into rest. Shall we not term it rather the day of her Accession; and say with good George Herbert:—

"Onely a sweet and vertuous soul,
Like season'd timber, never gives;
But though the whole world turn to coal,
Then chiefly *lives*"?



REPORT ON THE METEOROLOGICAL OBSERVATIONS MADE IN THE SOCIETY'S GARDENS AT CHISWICK IN 1901.

By EDWARD MAWLEY, Past-President R.Met.Soc.

THERE has been no change during the year in the position of any of the instruments, and the readings have been taken regularly, as in the two previous years, at 9 A.M. each day. The observations reflect great credit on the observer, Mr. T. W. Turner. After carefully checking the entries in the observation book I have been able to detect but six entries which appeared to me in any way doubtful, and there were only five instances in which the adding up of any of the columns was inaccurate. In June last I tested all the thermometers and found them in good working order and reading correctly.

A Brief Monthly Summary of the Observations taken in the Society's Gardens at Chiswick in 1901.

January.—Warm and dry. The days were as a rule about 1 degree warmer, and the nights about 1 degree warmer, than is seasonable. On the coldest night the thermometer on the grass showed 13 degrees of frost.

The rainfall was light, being less than half the average quantity for the month.

Mean temperature of the air in shade ...	39°.0		
Highest ,, ,, ,, ...	54°.6	on the 27th	
Lowest ,, ,, ,, ...	26°.5	,, 8th	
Lowest ,, on the grass ...	19°.1	,, 15th	

	At 1 ft. deep	At 2 ft. deep.	At 4 ft deep.
Mean temperature of the soil at 9 a.m. ...	40°.5	43°.4	46°.3
Highest ,, ,, ,, ...	44°.4	45°.6	48°.1
Lowest ,, ,, ,, ...	37°.3	41°.8	45°.3

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) ... 88

Rain fell on 11 days to the total depth of ... 0·85 in.

(Equivalent to about 4 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... 0·17 in. on the 27th

On the 8th the ground was covered with snow to the average depth of ... 2 ins.

February.—Very cold and rather dry. The days were, as a rule, about 4 degrees colder, and the nights about 3 degrees colder, than is seasonable. On the coldest night the exposed thermometer showed 17 degrees of frost.

The rainfall was rather light, being about a quarter of an inch less than the average quantity for the month.

Mean temperature of the air in shade ...	36°.2		
Highest ,, ,, ,, ...	51°.6	on the 28th	
Lowest ,, ,, ,, ...	20°.7	,, 14th	
Lowest ,, on the grass ...	14°.6	,, 14th	

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	37°.5	40°.3	43°.8
Highest " " "	41°.4	41°.9	45°.5
Lowest " " "	35°.3	39°.0	42°.6

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 85

Rain fell on 7 days to the total depth of ... ... 1·15 in.

Equivalent to about 5 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·48 in. on the 4th.

On the 5th the ground was covered with snow to the average depth of ... 2 ins.

March.—Very cold and wet. The days were, as a rule, about 4 degrees colder, and the nights about 1 degree colder, than is seasonable. On the coldest night the thermometer on the grass showed 16 degrees of frost.

The rainfall was heavy, being more than half an inch in excess of the average quantity for the month.

Mean temperature of the air in shade ... ... 40°.0

Highest " " " .. .. 55°.1 on the 5th

Lowest " " " ... ... 24°.1 " 29th

Lowest " on the grass ... ... 16°.0 " 29th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	40°.8	42°.4	44°.0
Highest " " "	43°.1	43°.2	44°.2
Lowest " " "	37°.4	40°.9	43°.2

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 84

Rain fell on 13 days to the total depth of ... ... 1·97 in.

(Equivalent to about 9 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·49 in. on the 30th

April.—Warm and wet. The days were, as a rule, about 2 degrees warmer than is seasonable, while the nights were of about average temperature. On the coldest night the thermometer on the grass showed 12 degrees of frost.

The rainfall was heavy, being about three-quarters of an inch in excess of the average quantity for the month.

Mean temperature of the air in shade ... ... 48°.8

Highest " " " ... ... 73°.8 on the 23rd

Lowest " " " ... ... 27°.9 " 2nd

Lowest " on the grass ... ... 20°.1 " 2nd

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m	47°.4	46°.7	45°.7
Highest " " "	54°.0	51°.1	48°.5
Lowest " " "	41°.2	42°.1	43°.5

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 65

Rain fell on 16 days to the total depth of ... ... 2·20 in.

(Equivalent to about 10 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·58 in. on the 3rd

May.—Warm and exceptionally dry. The days were, as a rule, about 2 degrees warmer than is seasonable, while the nights were of about average temperature. On the coldest night the thermometer on the grass showed 5 degrees of frost.

The rainfall was exceptionally light, being less than a quarter of the average quantity for the month.

Mean temperature of the air in shade	53°.9	
Highest „ „ „	82°.5	on the 29t
Lowest „ „ „	33°.8	„ 1st
Lowest „ on the grass	27°.0	„ 18th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	54°.5	52°.9	50°.5
Highest „ „ „	62°.0	57°.1	52°.9
Lowest „ „ „	49°.8	50°.2	48°.8

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 66

Rain fell on only 6 days, to the total depth of ... ... 0.45 in.

(Equivalent to about 2 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·21 in. on the 9th

June.—Seasonable in temperature and rather dry. The days were, as a rule, about 1 degree warmer, and the nights about 1 degree colder, than is seasonable. On the coldest night the thermometer on the grass showed 4 degrees of frost.

The rainfall was rather light, being less than half an inch below the average quantity for the month.

Mean temperature of the air in shade	59°.4	
Highest „ „ „	79°.8	on the 9th
Lowest „ „ „	37°.5	„ 19th
Lowest „ on the grass	27°.5	„ 19th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	61°.9	59°.2	55°.3
Highest „ „ „	65°.2	61°.5	56°.8
Lowest „ „ „	58°.3	57°.2	53°.1

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 66

Rain fell on 10 days to the total depth of ... ... 1·56 in.

(Equivalent to about 7 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·90 in. on the 30th

July.—Very warm and dry. The days were, as a rule, about 5 degrees warmer, and the nights about 2 degrees warmer, than is seasonable. On the coldest night the thermometer on the grass fell to 38 degrees, or 6 degrees short of the freezing-point.

The rainfall was light, being more than half an inch below the average quantity for the month.

Mean temperature of the air in shade	65°.4	
Highest „ „ „	88°.3	on the 19th
Lowest „ „ „	45°.5	„ 9th
Lowest „ on the grass	37°.9	„ 9th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	65°.9	63°.1	58°.8
Highest „ „ „	70°.7	65°.9	60°.3
Lowest „ „ „	62°.3	60°.7	57°.0

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 68

Rain fell on 10 days to the total depth of ... ... 1·75 in.

(Equivalent to about 8 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·66 in. on the 27th

August.—Warm and dry. The days were, as a rule, about 2 degrees warmer than is seasonable, while the nights were of about average temperature. On the coldest night the thermometer on the grass fell to 37 degrees, or 5 degrees short of the freezing-point.

The rainfall was light, being more than half an inch below the average quantity for the month.

Mean temperature of the air in shade	62°.8
Highest " " "	85°.2 on the 10th
Lowest " " "	45°.8 on the 23rd and 28th
Lowest " on the grass	36°.9 on the 23rd

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	64°.1	63°.1	60°.3
Highest " " "	67°.8	64°.5	60°.5
Lowest " " "	58°.9	60°.8	59°.7

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 66

Rain fell on 10 days to the total depth of ... ... 1·83 in.

(Equivalent to about 8 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·42 in. on the 27th.

September.—Warm and dry. The days were, as a rule, about 1 degree warmer, and the nights about 1 degree warmer, than is seasonable. On the coldest night the thermometer on the grass showed 3 degrees of frost.

The rainfall was light, being more than three-quarters of an inch below the average quantity for the month.

Mean temperature of the air in shade	58°.1
Highest " " "	75°.2 on the 8th
Lowest " " "	37°.5 " 16th
Lowest " on the grass	29°.0 " 16th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	58°.8	59°.3	58°.5
Highest " " "	62°.3	61°.1	59°.7
Lowest " " "	56°.5	58°.3	57°.8

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 78

Rain fell on only 6 days to the total depth of ... ... 1·67 in.

(Equivalent to about 8 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·60 in. on the 20th

October.—Warm and dry. The days were, as a rule, about 2 degrees warmer, and the nights about 1 degree warmer, than is seasonable. On the coldest night the thermometer on the grass showed 7 degrees of frost.

The rainfall was light, being nearly three-quarters of an inch less than the average quantity for the month.

Mean temperature of the air in shade	50°.0
Highest " " "	73°.0 on the 1st
Lowest " " "	29°.9 " 27th
Lowest temperature on the grass	25°.2 " 28th

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 87

Rain fell on 15 days to the total depth of ... ... 1·90 in.

(Equivalent to about 9 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·27 in. on the 4th

November.—Very cold and exceptionally dry. The days were, as a rule, about 3 degrees colder, and the nights about 3 degrees colder, than is seasonable. On the coldest night the thermometer on the grass showed 20 degrees of frost.

The rainfall was exceptionally light, being less than a quarter of the average quantity for the month.

Mean temperature of the air in shade	40°.4		
Highest „ „ „	54°.4 on the 11th		
Lowest „ „ „	21°.1 „ 16th		
Lowest „ on the grass	11°.5 „ 16th		
	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	42°.2	46°.4	50°.0
Highest	47°.3	50°.8	52°.7
Lowest	37°.2	42°.9	47°.3

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 84

Rain fell on only 4 days, to the total depth of ... ... 0·51 in.

(Equivalent to about 2 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·27 in. on the 1

December.—Seasonable in temperature and exceptionally wet. The days were, as a rule, about 1 degree warmer than is seasonable, while the nights were of about average temperature. On the coldest night the thermometer on the grass showed 13 degrees of frost.

The rainfall was exceptionally heavy, being more than double the average quantity for the month.

Mean temperature of the air in shade	38°.9		
Highest „ „ „	55°.9 on the 30th.		
Lowest „ „ „	23°.3 „ 17t		
Lowest „ on the grass	18°.6 „ 19th		
	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	38°.9	42°.1	45°.9
Highest „ „ „	45°.1	45°.3	47°.2
Lowest „ „ „	35°.4	39°.3	43°.7

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 87

Rain fell on 15 days to the total depth of ... ... 3·38 in.

(Equivalent to about 16 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·77 in. on the 12th

The Diagrams.—The averages with which the different mean monthly temperatures are compared in diagrams 1 and 2 are derived from the observations taken at Kew Observatory during the twenty-five years ending 1895. The actual averages for Kew have not been used, but the departures in mean temperature, &c., from the monthly means for 1901 at that Observatory have been applied to the Chiswick temperatures; and in this way very close approximations to the true monthly averages have been obtained. Mr. Glaisher's discussion of the Chiswick temperatures, 1826–69 (referred to in Vol. xxiii. page 391), was not available for this purpose, as it gives no maxima or minima temperatures. The rainfall averages used in diagram 1 are, however, those given by Mr. Glaisher for the forty-four years ending 1869 at Chiswick. ...

Diagram 1.—This diagram (fig. 337) shows at a glance the general character of the weather of each month of the year under discussion as regards temperature and rainfall. For instance, it will be seen that there were only three months—February, March, and November—which were in any way unseasonably cold. On the other hand, there occurred only one month, July, of exceptional warmth. Then, as regards rainfall, it will be noticed that in only three months—March, April, and December—did the rainfall exceed the average. All the other months of the year

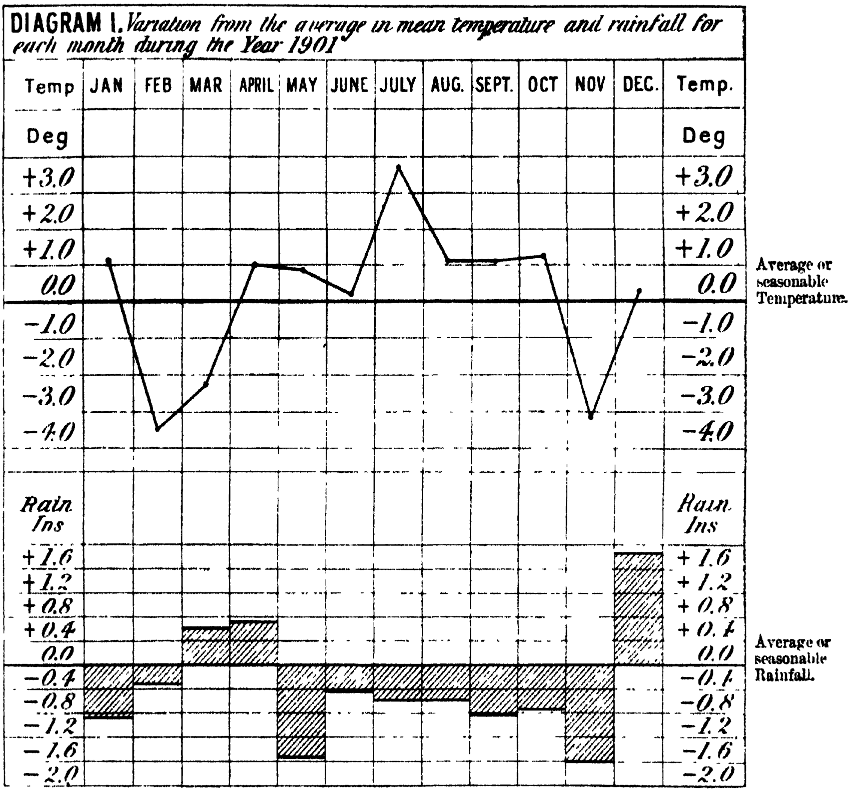


FIG. 337.

were more or less unseasonably dry, including that remarkable series of seven consecutive dry months, May to November.

Diagram 2.—Here (fig. 338) the most noteworthy feature is the unusual warmth of the weather in July during the daytime. In February and November the night temperatures will be seen to have been as unseasonably cold as those during the daytime. In March, although the days were very cold, the night temperatures proved in no way exceptional.

Diagram 3.—It will be noticed (fig. 339) that in the coldest month, February, the soil at 4 feet deep was on an average as much as 8 degrees warmer than the air, at 2 feet deep 4 degrees warmer than the air, and $1\frac{1}{2}$ degrees warmer than the air at 1 foot deep; whereas in the warmest

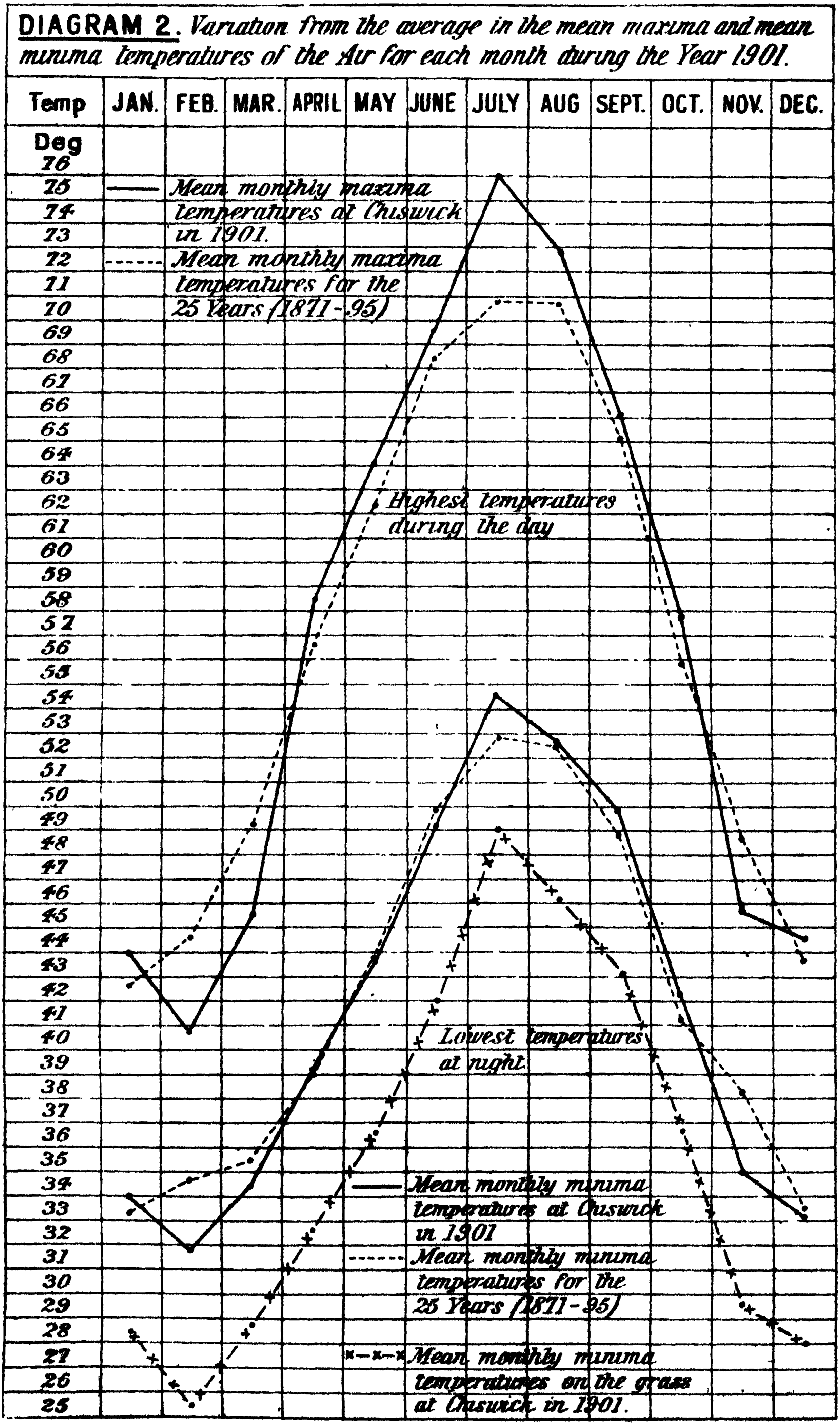


DIAGRAM 2. Variation from the average in the mean maxima and mean minima temperatures of the Air for each month during the Year 1901.
Temp
JAN.
FEB.
MAR.
APRIL
MAY
JUNE
JULY
AUG
SEPT.
OCT.
NOV.
DEC.
Deg
76
75
74
73
72
71
70
69
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
Mean monthly maxima temperatures at Chiswick in 1901.
Mean monthly maxima temperatures for the 25 Years (1871-95)
Highest temperatures during the day
Lowest temperatures at night.
Mean monthly minima temperatures at Chiswick in 1901
Mean monthly minima temperatures for the 25 Years (1871-95)
Mean monthly minima temperatures on the grass at Chiswick in 1901.

FIG. 338.

month, July, the soil at 4 feet deep was on an average as much as 7 degrees colder than the air, at 2 feet deep $2\frac{1}{2}$ degrees colder than the air, but at 1 foot deep it was about half a degree warmer than the air.

DIAGRAM 3. *Mean Temperature of the Air at Chiswick, compared with the mean temperature of the Soil at 1 ft. 2 ft. and 4 ft. deep for each month during the Year 1901, taken at 9 a.m.*

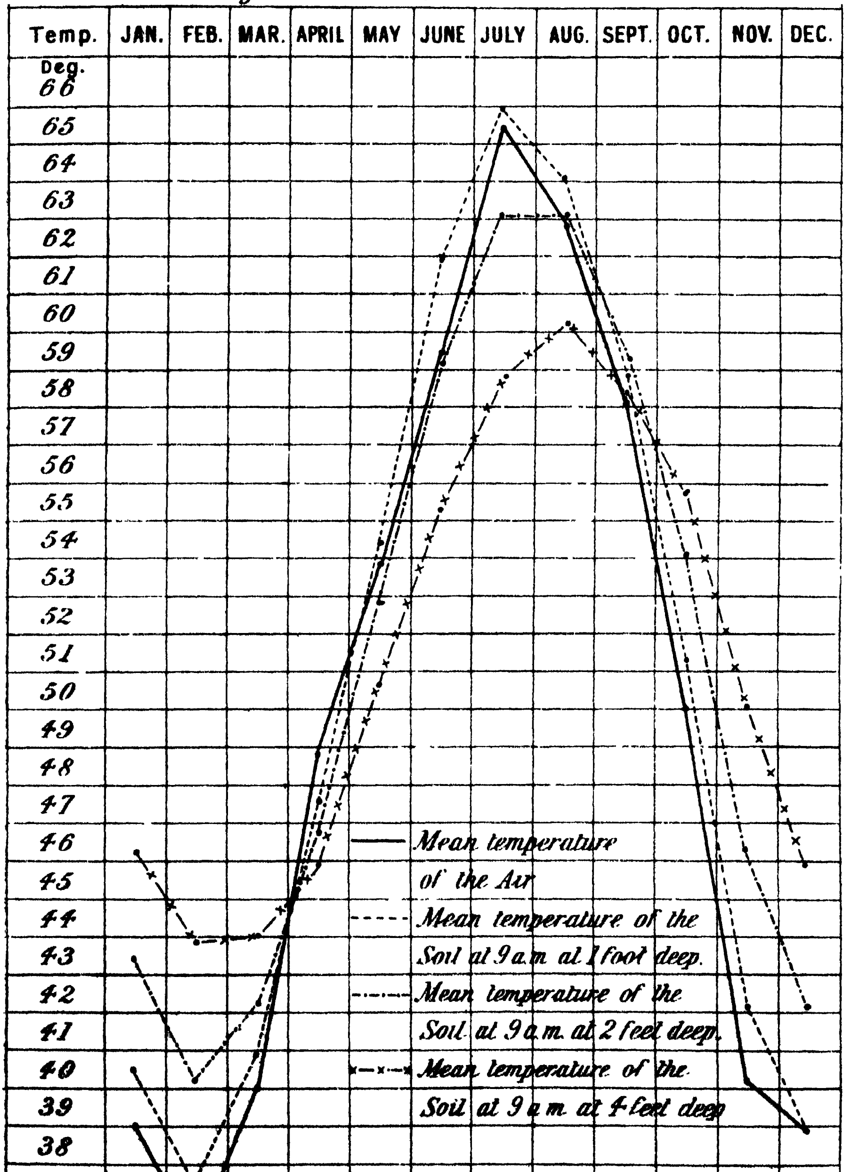


FIG. 339.

REPORT UPON AN INVESTIGATION OF THE CODLIN MOTH IN IDAHO IN 1900. By C. B. Simpson.

[Bull. No. 30, N.S., U.S. Dep. Agr. Div. Ent., pp. 51–63.]

[*As this Paper is likely to be of very great service to British fruit-growers, it has been thought desirable to give it in detail. It should be borne in mind, however, that the pest in question is in Great Britain single-brooded, or rarely double-brooded. The general treatment of the pest might, nevertheless, with due care, effect corresponding results in this country.—R.N.*]

The following report upon an investigation of the codling * moth in the State of Idaho is made in accordance with the authorisation of the Secretary of Agriculture and instructions of the Chief of the Division of Entomology.

Upon reaching Boise I commenced a rigid inspection of orchards in that vicinity and observed the methods used against the codling moth and the results of the same. Numerous cages were started for the study of the life-history of the insect. Many articles upon the insect were published in the leading papers. These articles were copied by many of the other papers. I also had a long conference with Professor Aldrich, of the University of Idaho, in regard to the codling moth.

Extent of Injury.

Indications of damage caused by the codling moth were seen in every section of the State which I visited where apples are grown. By report the moth is present all over the State, except in a few limited localities in the mountains. From my observation I can say without hesitation that 50 per cent. of the apple crop of Idaho was destroyed by the codling moth in 1900. According to Mr. McPherson the loss in South Idaho and about Lewiston for the districts was 75 per cent.

In untreated orchards I found a great difference in the percentage of apples infested. The injury ranged from 40 per cent. to practically 100 per cent. In the small orchards and isolated trees in and about Boise I have been unable to find sound apples. In the larger untreated orchards, which were more or less isolated, I found in some cases the injury to be about 40 per cent. In orchards well cared for I estimated the injuries to vary from 50 to 0·05 per cent. In an orchard near Boise that was sprayed and banded 44 per cent. of the crop was lost. In an orchard in the city of Boise that was sprayed with arsenites and banded the loss was only about 20 per cent. In more or less isolated orchards that were well cared for the loss was found to be 10 per cent. or less. In another orchard near Boise, which had been sprayed three times and not banded, the injury was from 90 to 98 per cent. In an orchard that was only banded the injury was about 60 per cent.

* The word is so spelt in America, but the old English name of the Apple from which the moth takes its name was and still is "Codlin." -Ed.

About Lewiston the damage is somewhat less than in the southern part. Professor Aldrich tells me that in 1899 the damage about Moscow was 21 per cent., while in 1900 it was only about 10 per cent.

I have been informed that in small valleys in the mountains the codling moth does no damage. The apple is the fruit most infested. The injury to pears never exceeds 0·05 to 10 per cent.

Introduction and Spread.

Previous to 1887 the codling moth was practically unknown in Idaho. It was probably present before that time, but did so little damage as not to be noticed.

The moth, without doubt, came into the northern part by way of the Snake River valley. Its spread was rapid, although checked to some extent by the long distance between orchards.

The sections which are shipping apples are now all infested. The newer orchards are more or less free, but cannot remain so very long.

Resistance of Varieties of Apples.

Only scattered observations were made upon this point, and these do not harmonise. Some of the varieties in order of damage sustained are: —

1. Pewaukee (always badly infested).
2. Spitzenberg.
3. Bell-flower.
4. King.
5. Gravenstein.
6. Wealthy (very variable).
7. Ben Davis (very variable).
8. Rome Beauty (very variable).
9. Winesap (but little infested).

This question is believed to be one of the most important to be worked out, as in general the apples given as least infested are the best varieties for Idaho.

Life-history of the Codling Moth.

The life-history, as usually given, applies to the insect in a climate far different from that of Idaho. On this account I spent much time in studying the variations in the life-history.

The Egg.

The eggs can be found at any time during the summer, either upon the fruit or upon the upper surface of the leaves. In certain orchards the eggs were almost entirely upon the fruits; in orchards near by they were nearly all upon the leaves. Where apples were in abundance there were but few eggs upon the leaves, and where apples where scarce but few eggs were upon them. Apparently the moth prefers to lay its eggs upon the fruits.

The eggs have been described as whitish, milk-like spots. They adhere closely to the fruit or leaf, and even after hatching the shells remain for a long time. When the egg is a few days old a brown horse-shoe-shaped band appears, indicating the embryonic larva.

The Larva.

In from about six to eight days the larva is fully formed and breaks

its way out of the shell. Most of them come out through the top covers, but a few were observed in which the larvæ had evidently emerged through the lower surface of the egg, next to the apple or leaf.

The young caterpillar is about one-fifteenth of an inch in length and is of a semi-transparent colour. Later dark spots appear around the hairs.

The young larva, after piercing the apple, makes a shallow mine just under the skin. Those mines can be easily recognised by the lighter colour and by the excrement which is cast out. The larvæ which enter by the calyx also take their first few meals at the surface inside the calyx.

By counting infested apples on unsprayed trees I found that about 60 per cent. of the larvæ of the first brood enter at the calyx end. In the later broods but few enter the calyx end. Many enter the apple at the stem end. The greater proportion, probably from 60 to 90 per cent., enter at any part of the apple. A favourite place of entrance is at the point where two apples touch.

At the end of four or five days the larva commences to tunnel toward the central portion of the fruit. Arriving at the centre, it commences irregular excavations, which are filled with excrement, the pellets of which are bound together by silken threads. Surrounded by abundance of food, the insect grows rapidly, casting its skin many times. I have found many burrows, sometimes as large in diameter as a full-grown larva, in which no larva could be found; therefore I believe that sometimes a larva feeds upon more than one fruit. In all cases where fruits touch they are both injured.

While one larva usually feeds upon but one apple, one apple may be eaten by many larvæ. A large apple was found with thirteen worm-holes in it, both entrance and exit, and three larvæ, of various sizes, were feeding inside. It is a very common occurrence to find from four to seven holes in an apple. These different holes are usually made by insects of different broods. In a badly infested orchard the earlier apples rarely had but one insect in each. A larval stage of from ten to fourteen days, as given by Professor Card, is, I think, nearly correct for Idaho.

On summer apples and most fall apples the effect of the insect is to cause the fruit to ripen prematurely. In the winter varieties, such as Winesap, there is no such ripening. In all cases the fruit is rendered unfit for use. When full grown the larva eats its way to the surface of the apple. The burrow is kept closed by frass, or sometimes an adjacent leaf is fastened over the hole with silk. Having eaten as much as it desires, the larva pushes out the plug or removes the leaf and leaves the fruit. In warm weather the worms, for the greater part, leave the apples in the early evening or night; but in colder weather, in the fall, they emerge during the heat of the day. If the fruit has fallen, the larva crawls along the ground to a suitable place to spin its cocoon. The worms have two modes of leaving the fruit left on the tree. In some cases they drop by a silken thread to the ground. I have observed a larva hanging by this thread, and many threads were noted hanging from the trees. The other, and by far the most common method, is for the larvæ to crawl from the apple to a branch and thence to the tree-trunk.

Upon leaving the apple the worm immediately seeks a place to spin the cocoon. The place usually selected is under rough, loose bark, in cracks or holes of the tree-trunk and larger branches, under bands or cloths on the trees—in fact, in almost any dark and tight crack or crevice. Many cocoons are placed in cracks in the ground about the trees. This is especially true when the tree-trunk is smooth and offers no suitable place. Mr. McPherson says he has found many cocoons among the clods of earth in his orchard. Where apples are stored the worms spin the cocoons in the boxes. I have found as many as thirty cocoons in and on one box. Having found a satisfactory place, the larva spins a tough silken case. In the earlier broods the larvæ spin their cocoons quite thin and do not usually use other substances than silk in its construction. The last brood, however, build their cocoons thicker, and in nearly all cases hollow out a space for it and mix little pieces of wood, bark, or cloth with the silk. The larva is bent in a U shape in the cocoon. If the cocoon be destroyed, the larva will set to work immediately to build another or to repair the old one, if it be not completely destroyed.

The Pupa.

In from three to five days in the summer the larva sheds its skin and becomes a pupa. In the last brood the larval stage lasts until the spring. The pupa is at first of a yellowish colour, later becoming brown and then bronze in colour. When the moth is ready to emerge, the pupa, aided by the spines on the abdominal segments, wriggles itself out of the cocoon. I have seen empty cases that had been thrust through heavy muslin which was used as a band.

These empty pupal skins are familiar objects upon infested trees. I once counted fifty of them protruding from under pieces of bark in a space of about a square foot. During the warmer season the time spent in the cocoon is from seven to eleven days. Many stay in a longer, but very few a shorter time. The last brood stay in the cocoon about eight months.

The Moth.

The moth is a beautiful insect whose front wings have the colour of brown watered silk, and are crossed by lines of brown and grey scales. Near the tip of the wing is a large bronze-coloured spot. The hind wings, which are concealed during repose, are of a greyish colour. The moth varies in size, but never expands over an inch. The sexes may be distinguished readily by the fact that the male has a streak of black hairs upon the upper surface of each hind wing, and upon the under surface of each front wing there is a long blackish spot. The relative number of moths of each sex is about equal.

The adult insect is rarely seen. In my summer's experience I saw but five. These were either resting upon the upper surface of the leaves or were upon the trunk or larger branches. In warm evenings by aid of a light I saw a few flying about the trees.

It has long been known that the moth is not attracted to lights. I examined the contents of an electric (arc) light globe that was near an orchard without finding a single codling moth.

It has been observed that the moths feed upon apple-juice, and I saw two moths feeding upon the juice of a crushed apple. Mr. Hitt tells me that it is common to find moths about cider mills. I have found that if a piece of ripe apple was placed in a cage of moths they would lay eggs in abundance, and if the apple was wanting no eggs or but few would be laid.

After laying eggs, the moths in cages die in about a week.

Broods of the Insect.

In view of the fact of the difference of altitude and temperature in Idaho, there must exist a corresponding difference in the number of broods.

Upon arriving at Boise I immediately commenced work upon this question. I found the overlapping of broods to be something remarkable. From July 7 to about September 1, I could find in the field all stages of the insect except the adult, which I could breed in cages. From my band records I find that while I kept records there were larvæ going under bands every day.

From the records of Mr. Ayers, of Boise (as given later), we find that in 1897 there were larvæ under the bands every week from June 25 to October 19. To sum up, we have every day throughout the season moths emerging and laying eggs, eggs hatching, larvæ coming out of apples and spinning cocoons, and larvæ changing to pupæ.

This fact, together with the number of broods, certainly explains why the codling moth is more injurious in the West than in the East. The overlapping can be accounted for by the difference in rate of development of different individual insects.

Professor Aldrich says that in the section from Boise to Weiser and about Lewiston there are at least three broods, and part of a fourth was observed at Boise this year (1899). Mr. McPherson, Mr. Hitt, and others have arrived at the same conclusion. Without doubt the number of broods in Fremont and Bingham Counties is less.

The following are the band records taken by Mr. Ayers, of Boise, on 140 trees:—

Date	Larvæ	Date	Larvæ
1897.		1898.	
July 2	862	July 5	1,118
July 9	704	July 13	2,201
July 16	1,268	July 20	2,020
July 23	740	July 27	1,454
August 2	606	August 3	1,335
August 9	290	August 10	963
August 18	580	August 17	1,095
August 25	684	August 24	1,125
September 2	1,526	August 31	1,580
September 10	1,227	September 7	1,474
September 21	1,340	September 14	1,860
October 4	1,642	September 22	1,965
October 19	778	October 1	1,594
		October 10	1,125

From the preceding record, from that of Professor Aldrich taken at Juliaetta for 1899, and my own I have compiled the following table :—

	1897	1898	1899	1900
First brood :—				
Maximum	July 16	July 13	July 21	July 15
Minimum	Aug. 9	Aug. 10	Aug. 12	Aug. 4
Second brood :				
Maximum	Sept. 2	Aug. 31	Aug. 18	Aug. 25
Minimum	Sept. 10	Sept. 7	Sept. 4	Sept. 1
Third brood :—				
Maximum	Oct. 4	Sept. 22	Sept. 25	Sept. 25
Minimum				

From these records, supplemented by observation, I can say definitely that there are three broods in the vicinity of Boise and the greater part of the Snake River valley.

As to the fourth brood I have no definite information at hand. Several growers have told me that such a brood exists in part. At certain periods it is impossible to say to what brood an insect belongs. For instance, in 1900, if a half-grown larva was found October 4 it would be impossible to know whether it was the last of the third or the first of the fourth. When cold weather comes, there are many interesting things apparent. If young larvæ are left in the fruit on the ground, they evidently perish. However, if taken inside with the apples they complete their development, and if not destroyed insure a crop of moths for the following spring. About September 5 it was noticed that the larvæ that had spun cocoons were not transforming, but were still in the larval state, while those that had reached the pupa state were developing slowly and the moths were emerging. It is evident that it takes a higher temperature for the insect to change from larva to pupa than from pupa to adult.

Moisture and Heat.

There is great mortality among the eggs of this insect, the direct rays of the hot sun causing many to die.

In the larval state, especially when young, there are many agencies of destruction. I have found tips of branches upon which there was but one apple. On the leaves near by there were half a dozen or so hatched eggs, while the apple contained but one larva. In one case the larva would have to crawl 20 feet before finding another.

In many cases I have found from 2 to 5 per cent. of the larvæ dead before they had commenced their burrow to the centre of the apple from the mine under the skin. There are very few deaths due to fungus and bacteria in the dry regions. In many orchards, in which the water used for irrigation is allowed to stand around the trees, the number of infested apples is markedly less than in those orchards where irrigation is by ditches. Also one does not, as a general rule, find as many worms under bands on trees which have moist soil around them. The only explanation is that the moisture either causes the insects to die by fungus or bacteria or to seek other places. This method, however, has grave

disadvantages, since water allowed to stand in an orchard will sooner or later kill the trees.

NATURAL ENEMIES.

I did not succeed in finding any egg parasites, but within a pupa I found a pupa of a Hymenopter, but the parasite did not emerge. It was probably a *Pimpla*. In another pupa I found many pupæ of a Hymenopterous parasite, which died before becoming adults. Under some neglected bands were many silk cocoons, probably of a *Microgaster*. Although they are not bred directly from the codling moth, there is little doubt but that they were from this insect.

While the larvæ are seeking a place to spin their cocoons in the daytime they are preyed upon by ants and birds. Chickens allowed in an orchard eat them readily. Often I have observed holes in the bark, and upon examination found empty cocoons. One evening several bats were noticed flying around apple-trees and probably feeding upon the moths.

PREVENTIVE MEASURES.

One of the best preventive measures is following the best general horticultural practices, such as keeping the soil and trees in healthy and vigorous condition and keeping a close watch upon the orchard. If a fruit-grower has no codling moths, what should he do to keep them out of his orchard? The answer to this question has many conditions, according to location, &c. To begin with, every grower should be familiar with this insect in all its stages and know how to fight it. An orchard may be at such an altitude that the insect will not be a very serious pest. In this case the small amount of damage should not be an excuse for letting it alone. It would be well for the grower to be careful in importing infested fruit, and to exercise utmost vigilance in watching his orchard, and if the moth is found, even in small numbers, no expense should be spared to apply the proper remedies immediately.

One source of trouble that can be easily prevented is that when apples are stored the larvæ emerge from the fruit, spin their cocoons, and upon emerging as moths in the spring find easy access to the orchard. I studied two well-marked cases of this. At Mr. C. M. Kiggins's place apples were stored in boxes in a cellar, in which there were open ventilators. I found many old cocoons in and about these boxes. When I examined the orchard, July 9, I found that in trees nearest the cellar practically all of the apples were infested. In going from the cellar a noticeable decrease was observed, and in the farthest part of the orchard the injury varied from 5 to 30 per cent.

In the well-kept orchard of Hon. Edgar Wilson a similar case was noted.

These examples show the futility of remedial measures when the moth has such a start. Both Mr. Wilson and Mr. Kiggins are fully aware of the above conditions, and will take care that the mistake is not repeated. Either of three courses may be followed: To fumigate with hydrocyanic-acid gas while the larvæ are in the cocoon, to put screens over the holes and crush the moths which will collect there, or not to store apples on the premises.

In some cases picking the apples early to escape a coming brood is practised. If the stages of the insect are known, this method may be followed to much advantage.

REMEDIAL MEASURES.

In fighting this insect, the first question which presents itself is, In what stage can the insect be best attacked, and how?

As a result of the work that has been done on this subject, it is evident that any mixture strong enough to kill the egg will injure the tree. Further work may throw more light upon this subject.

At two periods in this stage the insect is vulnerable, and a larger portion of the remedies have been used at these periods.

After the young larvæ hatch, and before they have started for the centre of the apple, has long been recognised as the most vulnerable point in the life of the insect. At this point spraying is a most effective remedial measure.

I found that in Idaho the fruit-growers were using many kinds of spraying solutions, with varying results.

A patent mixture, composed largely of carbolic acid and coal-tar, was used by some. This solution is supposed to have a smell about it that keeps the moth away from the tree. The best I have seen this solution do, with several excellent sprayings, in conjunction with bands, was to save 66 per cent. I believe that what good effects are derived from its use are due to the killing of the larvæ with which it comes in contact.

Many of the fruit-growers add an arsenite, usually Paris green, to the carbolic compound. The results with this mixture are varying.

Others have used kerosene in the arsenite, thereby combining both poisonous and contact insecticide. One grower used this combination, and writes me that "there are no wormy apples to be seen" (in his orchard), and that the apples injured by all sources amounted to only about 0·05 per cent.

One difficulty is to get these different ingredients to mix well. Whale oil soap is used in combination with other sprays, but I could find no facts in regard to the results of its use.

By far the greater number of growers use the arsenites alone. Of these arsenites Paris green is most used, in the proportion of one pound to 150 gallons of water, with from one to two pounds of freshly slacked lime.

Some are using London purple, and others are using a combination of London purple and Paris green. Many are using the lime arsenite with excellent results. In fact, wherever any of these arsenites are used intelligently good results are obtained. Some growers are prejudiced against certain of these arsenites on account of past experiences. In two cases I found that they had omitted the lime, and in both cases the foliage was badly burned.

My observations have led me to believe that it makes but little difference as to what arsenite is used if it is well applied.

The pumps used were of all kinds and conditions. Many were using nozzles which threw a coarse spray that was valueless. The time for spraying is as essential as the spraying itself, and I wish that this fact

could be impressed strongly upon the Idaho growers. One can readily see that a spray would do but little good when the maximum of a brood are going under bands, compared with a spray when the maximum of a brood is hatching from the egg. To secure good results, there must be at least three sprayings, and in extremely bad cases it is advisable to spray six times.

If the injury for the previous season was large, I would advise two sprayings while the calyx remained open—one immediately after the blossoms have fallen, and the other in about a week. If, however, the injury of the previous season was not large, one spraying from five days to a week after the blossoms have fallen may answer. In all cases I would advise the two sprayings, as it is well to be on the safe side.

It has become one of the best known principles of spraying that these first sprayings are the most efficient, and if it were not for the number of broods in Idaho these, I believe, would be sufficient. In short, the poison is put in the calyx cup, the calyx closes, and when the young larva enters the calyx for its first few meals it gets some of the poison. As about 60 per cent. enter the apple at this point, it is very plain that this is the golden opportunity in this combat. Professor Aldrich finds that 41 per cent. of the larvæ entering the calyx end are destroyed by this spraying. An insect killed at this time not only saves the apple, but reduces the number of the insects of the following broods. By a single spraying and by banding one prominent grower tells me that he can save 50 per cent. of his apples. Many people spray only once a season, and consequently the effect of it is lost later in the season. If rains wash off these sprays, they should be repeated immediately.

The next spraying should be done when the second brood is entering the fruit. Find the maximum of the preceding brood going under the bands and spray about two weeks later. It would probably be better to spray a few days earlier than two weeks. A few growers watch the increase of spots on the apples. The later sprayings should be determined in the same way. Other sprayings can be done with profit on account of the overlapping of the broods, but they should be made as near the maximum of egg-hatching as possible. In fact, late in the season, when the maximum is poorly defined, a spray is more or less effective at any time. Last year (1900) the dates, according to band records, for most effective spraying were June 10–15, July 27, and September 5. No inflexible rule can be given for these dates, as each grower has different conditions to meet, and seasons vary. Each grower must determine these dates for himself. The greater number of the growers simply space off the season and spray at empirical times, without regard to the stage of the insect, and obtain, as a consequence, poor results.

It has been clearly demonstrated that these few spraying alone are not always sufficient to control the insect. If the sprayings were made every week, the insect could be controlled, but this is too expensive. The spray is effective only for a short time, and must be supplemented by something to take the insects which enter the fruit between the sprayings. Banding has been found to be the most efficient in this connection.

Many people object to the use of arsenites for later sprayings on account of the liability of poisoning those who eat the fruit. I believe

this objection is not well taken, since one would have to eat an enormous quantity of apples to be affected. If a large amount of poison remained in the hollow around the stem of an apple, there might be some danger. I have eaten many apples upon which the spray still remained and experienced no evil effects.

During the growing period of the larvæ the infested apple may be picked from the trees and either destroyed or fed to stock. However, this method is so expensive in a large orchard that it is out of the question. If the people in the towns who have apple-trees more for shade than for the fruit would destroy their apples, they would aid materially in reducing the number of the pest, and would also eradicate a constant source of infection.

In the "windfalls" there is another chance to attack this insect. In many orchards the fallen apples literally cover the ground. Careful experiments have shown that about 50 per cent. of these fallen apples contain larvæ. Many methods may be used in the destruction of the windfalls. The best and easiest applied is to allow hogs or sheep to run in an orchard. These animals soon become very efficient and keep the ground well cleared. In doing this, the grower not only gets rid of the apples, but gets his stock fed upon food that would otherwise be wasted. Many growers collect the windfalls at stated intervals and make cider from them. At best, destruction of the windfalls is only partially effective, but is a useful ally to other methods.

When the larvæ are full-grown, and, after leaving the apples, are seeking places to spin their cocoons, another point of attack is opened.

Banding is simply providing a suitable place for the insect larva to spin its cocoon. Temporary bands of hay or paper, which are afterwards burned with the larvæ, may be used. Many kinds of permanent bands, which are not destroyed, have been devised, but a piece of cloth from 4 to 8 inches wide, folded lengthwise once, and placed around the trees is the most efficient and economical. These bands can be made of any thick dark-coloured cloth, such as pieces of old clothing or burlap. Professor Aldrich recommends brown Canton flannel. I have seen many bands that were but strips of white muslin, which did not offer an attractive place for the insect, and thus the purpose for which they were put on was defeated.

It is highly essential that before a band is put on a tree all places where the larvæ could spin up be removed. The rough bark should be removed from the tree, and all holes should be filled with either mud or mortar. I have obtained twenty larvæ from a hole in a tree. If a large cavity is present in the tree-trunk, bands should be placed above and below.

The bands should be placed around the trunk of the tree from about 1½ foot above the ground. If the tree is large it is best to put a band on each of the branches. Two bands on a tree-trunk are better than one, but if the tree is well scraped and the holes filled I think one wide band is sufficient. A convenient and time-saving device for fastening the bands on is to drive a small nail into the trunk and cut off the head diagonally so as to leave a sharp point. This nail is allowed to remain in the tree, and the ends of the band are pushed over it.

Apparently banding is more efficient in Idaho than in any other State where experiments have been made. The number of larvæ caught is sometimes very large. Professor Aldrich records that the highest number he found on one tree in a week was 110. Various persons have found from fifty to 190 on neglected trees. I once found 170 under a neglected band and a cloth in the crotch of a large tree. In 1898 Mr. Ayres obtained from six to fifteen worms per tree throughout the season. In the maximum in September I have obtained on large trees as many as twenty to thirty daily for a few days in a neglected orchard. Professor Aldrich records that in his banding experiments he obtained 215 worms per tree for the season of 1899.

The worms which have been collected under bands should be killed every seven days. Six days is recommended by some. I think six days too short, as but few moths emerge before seven or eight days. However, the person who is killing the larvæ can easily tell whether the time is too long or too short. If old pupal skins are found the time is too long, and if no larvæ have changed to pupæ the time is too short.

Many ways of killing the larvæ have been used, such as burning temporary bands, plunging the permanent bands in hot water, or running them through a clothes-wringer. I find that the majority of fruit-growers in Idaho simply crush the worms, or cut them with a knife. Hon. Edgar Wilson suggested to me that, as the larvæ used parts of the band and bark with which to build its cocoon, poisoning the band might be an easy way of getting rid of many. I tried soaking the cloth bands in strong solution of Paris green, but the results do not warrant any definite statement. I believe that this may kill some of the last spinning-up, but doubt its efficiency for the earliest broods. However, it is worthy of further investigation. In want of better knowledge many people apply bands and do not kill the worms that have collected. In this way the insect is positively aided. Professor Gillette records a fact that must be noted. He finds that in the spring the larvæ leave their old cocoons and migrate to other places and spin new ones. This, however, is not always the case, but it should be guarded against. Bands should be applied about two weeks after the blossoms have fallen, and be kept on for a week or so after all the fruit has been picked in the orchard.

Banding should always be practised in connection with spraying, and by this combination the best results are obtained.

By spraying with Paris green and London purple and by banding, Mr. Tiner, of Boise, saved about 80 per cent. of his apples. This orchard is in the city of Boise and has neglected orchards all around it.

Hon. Edgar Wilson used arsenites and banding. In the part of the orchard not infested by the moths from the apple-house the loss is estimated at from 5 to 10 per cent. In Mr. Fremont Wood's orchard the results were about the same.

Dr. Ustick, of Boise, used lime arsenite and banding. I estimated his loss to be about 10 per cent. I visited these last three orchards September 24, and, searching diligently under the bands for larvæ, found but three under thirty or forty bands. Mr. C. Hinze, of Payette, used Paris green with either kerosene or coal-tar. He writes me that his total loss from all causes amounted to only 0·05 per cent.

For contrast it might be mentioned that in Mr. Tiner's orchard I found only eight larvæ under bands at eighteen trees, while in a neglected orchard on the same date (September 21) I found ninety-four larvæ on ten trees.

In all these cases cited the orchards were sprayed from four to six times.

The pupæ may be killed with the larvæ under the bands by crushing. They are so well protected that this is the only practical way to reach them.

I have previously stated how the adults in a storehouse may be killed. A few fruit-growers have told me that they caught numerous adult codling moths by trap lanterns. All accurate work upon this point has shown that the moth is not attracted to light, the noctuids and sphingids caught being mistaken for codling moths.

One grower says he catches many of the moths in buckets in which there is some cider or vinegar. This fruit-grower is a man well informed upon the subject, and I tried to experiment with his remedy, but was stopped by cold weather and sickness.

Summary and Conclusions.

1. The codling moth is more injurious in Idaho than in the East on account of the number and the overlapping of broods.

2. There are three broods and probably a part of a fourth, which overlap.

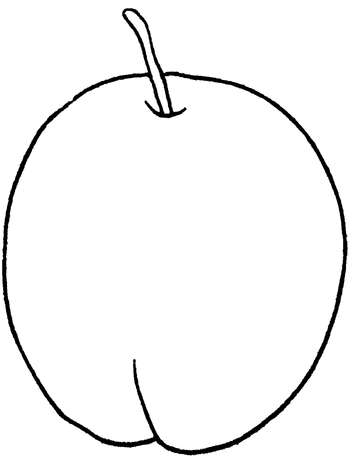
3. The moth cannot be controlled by natural means.

4. It has been allowed to get a firm foothold in the State.

5. By several sprayings with arsenites and by banding the injury may be reduced to from 5 to 20 per cent., depending upon locality.

6. I firmly believe that, if the recommendations given here be followed by all fruit-growers in a locality for one or two years, the moth would cease to be a serious pest in that locality.

I recommend that this work be carried on in Idaho and possibly Oregon and Washington another year, as I believe this last summer's work has simply outlined the problem and discovered the points to be worked upon.



MAY-FLOWERING COTTAGE AND SPECIES TULIPS.

REPORT ON THE HAARLEM TULIP TRIALS, 1901.

By ERNST H. KRELAGE.

THE revived and increasing interest in May-flowering Tulips induced the Council of the General Bulb Cultural Society of Haarlem to arrange trials of this class of Tulips last May. The trials were held on May 14 and 21. On the first day sixteen growers sent 321 vases with flowers, and on the second day twenty-six growers were represented by 626 vases. The Nomenclature Committee * inspected all the varieties in order—

(*a*) To fix one official name for each variety ;

(*b*) If possible, to furnish an accurate description of each variety ; and

(*c*) To prepare a report for the members of the Society.

It has been suggested by some of our friends across the water to publish a report of the trials in English for the use of British Tulip-growers and amateurs, and I have much pleasure in preparing such a report.. The Journal of the Royal Horticultural Society, vol. xxv. p. 178, contains a similar report on the Tulip trials held at Chiswick in 1900, and as the Haarlem Committee have tried to keep to the names fixed at Chiswick as far as possible, the two reports complete each another.

I should say that the report below has not an official character, as the form of the Dutch report proved unsuitable for translation for the use of British readers. I have, therefore, preferred to publish the results of the Haarlem Tulip trial in a more concise form by preparing one general list of all the varieties inspected, by completing the descriptions not given in the Dutch publication, and by adding literary references and a complete list of synonyms. The alphabetical order is not an ideal one, and some classification of the May-flowering Tulips according to shape of flowers or similar characters will doubtless prove necessary in the near future. Such classification can, however, only be fixed by mutual consent and after careful deliberation, and I have therefore chosen the alphabetical arrangement for the present.

The Haarlem Committee, as a rule, have tried to fix the shortest and fancy names, to reject Latin names, unless already quite familiar, and to drop such indefinite specific (?) names as *Gesneriana* and *Billietiana*, &c., for varieties, whose descent from the species named seems at least very doubtful.

Only a very few of the varieties sent for inspection have not yet been registered, but the work of the Committee has practically been completed as far as all the best known cottage Tulips are concerned. The task of the Committee did not include the other strains of late Tulips, such as Breeder, Darwin, and Rembrandt Tulips, Bizarres, Byblœmen (Violettes),

* Messrs. Ernst H. Krelage (in the Chair), P. W. Voet (Hon. Sec.), J. de Graaff, J. M. C. Hoog, G. van der Horst, E. Kersten, G. J. van Meeuwen, A. Roozen, jun., and C. Geytenbeek, jun.

and Roses, or Parrot Tulips. The following list contains 144 distinct cottage and species Tulips, whereas the Chiswick report only refers to thirty-eight varieties of the same class :—

1. Acuminata, Vahl. (*syn.* cornuta, stenopetala).—Long narrow petals, scarlet and yellow. Chiswick, Nos. 110, 120, and 121. *Red. Lil.* t. 445 ; *Bot. Reg.* t. 127 ; *Lois. Herb. Amat.* iii. t. 171 ; *Drap. Herb. Amat.* v. t. 327 ; *Album v. Eeden*, tab. 80.

2. Acuminata lutea.—Nearly pure yellow sport of the former.

3. Armena, Boiss.—A dwarf-growing species, with massive crimson flowers with a black eye at the base.

4. Aurora.—A showy cottage of the Billietiana type, but with larger flowers ; yellow, heavily tinged with deep scarlet at the border.

5. Avis Kennicott.—A most beautiful large flowering yellow Tulip, not yet in the trade.

6. Aximensis.—From Savoy ; crimson-scarlet, with black basal eye.

7. Batalini, Regel.—A dwarf species with pale sulphur flowers ; very scarce. *Gartenflora*, 1889, t. 1307, fig. 2 ; *Gard. Chron.* 1896, i. fig. 131. **A.M.** (R.H.S.) May 28, 1900. (Fig. 340.)

8. Beauty of America.—Pale sulphur-yellow, passing to a sulphury-white.

9. Billietiana, Jord.—From Savoy ; yellow with orange-scarlet margin ; very showy. Chiswick, No. 113. *Rev. Hort.* 1887, p. 399, fig. 81. (Fig. 342.)

10. Billietiana nana (*syn.* Biebersteiniana *false*).—A dwarf, small-flowering form of the above ; very late. Chiswick, No. 114.

11. Blyhof.—A bold flower, rosy-pink and white.

12. Bouton d'Or (*syn.* Ida, Lutea, Golden Beauty).—Showy orange-yellow flowers, with black anthers. Chiswick, Nos. 116 and 134. *Garden*, 1895, t. 1035, fig. 1 ; *Floril. Haarl.* t. 59, fig. 2.

13. Bridesmaid (*syn.* Gesneriana striata).—Bright rose, heavily streaked with white, blue centre. Chiswick, No. 130.

14. Bronze King.—Large flower, rich bronze.

15. Buenaventura.—Scarlet, striped and flaked with golden yellow. Chiswick, No. 117.

16. Caledonia.—Bright fiery-scarlet, black and yellow base.

17. Canary.—A new pure yellow cottage Tulip.

18. Carinata rubra.—Dull crimson, centre of petals yellowish green. Chiswick, No. 118.

19. Carinata violacea.—Like the former, with rosy-violet instead of dull crimson.

20. Celsiana, D.C.—From the South of France. A form of the well-known T. australis or persica, from the Levant.—*Redouté, Liliacées*, t. 38.

21. Ciliatula, Baker.—From Asia Minor. Red, with black central blotch.

22. Cloth of Gold (*syn.* Billietiana 'Cloth of Gold').—Yellow, margined orange-scarlet.

23. Clusiana, D.C., the 'Lady Tulip.'—White, striped red, with violet base. *Red. Lil.* t. 37 ; *Bot. Mag.* t. 1,390.

24. Columbus (*syn.* 'French Crown,' 'Gala Beauty ').—Pointed petals,

rich crimson, heavily striped and edged yellow, softly fragrant. Chiswick, Nos. 119, 128, and 129. *Red. Lil.* tab. 477.

25. Columbus.—With variegated leaves.

FIG. 340.—TULIPA BATALINI. (*Gardeners' Chronicle.*)

26. Concinna, Baker.—From Taurus Mountains. Red, with black centre.

27. Coquette de Belleville.—Rosy-crimson, edged white.

28. Coquette Orange.—A sport of the former, with orange-salmon flower.

29. Couronne tardive.—The latest of all. Small flowers sulphury-yellow, with a narrow red border.

30. Crested Crown.—Somewhat resembling 'Columbus,' but of a more dark crimson; flowers conspicuously crested, like Parrot Tulips.

31. Cupido.—Yellow and red.

32. Dame Blanche.—Large flowers, silvery white. One of the earliest late Tulips.

33. Dame élégante (*syn.* 'Bonte Zwaan').—The variegated form of the former, with crimson lines and feathers.

34. Didieri, Jord.—From Savoy. Tall, showy crimson, with a dark centre, surrounded with a primrose-yellow band. Chiswick, No. 122. *Jord. Icon.* 8, t. 17; *Bot. Mag.* t. 6,639; *Levier, Tul. Eur.* t. 3.

35. Didieri alba.—Probably not belonging to the former, but generally known under this name. A dwarf variety; flowers rosebud-shaped, silvery white, sweet-scented. Chiswick, No. 123.

36. Didieri flore pleno.—A full double form of the type.

37. Didieri lutescens.—Like the type. Flowers sulphury-yellow, with dark basal blotch.

38. Eldorado.—A fine deep-yellow flower.

39. Elegans.—Pointed reflexed petals, scarlet, with yellow centre. Chiswick, No. 124. *Garden*, 1887, t. 625; *Album van Eeden*, t. 80.

40. Elegans alba.—Pointed petals, very narrow rose edge. Chiswick, No. 125. **A.M.** (R.H.S.) May 14, 1895.

41. Elegans maxima lutea.—Large long-petalled flowers, orange-yellow.

42. Elegans sulphurea.—A most showy pure sulphury-yellow sport of the type. Immense flower, of typical elegans shape.

43. Elegans variegata.—Scarlet, flaked and feathered yellow. Chiswick, No. 126.

44. Fairy Queen.—Heliotrope, edged yellow, very distinct.

45. Firefly.—Orange-red, centre green and yellow.

46. Flamed Crown.—A bold flower, brilliant carmine-scarlet, with conspicuous yellow bands and border.

47. Flava.—An old garden Tulip, with pale-yellow flowers of exquisite beauty.

48. Fransoniana, Parl.—Quite distinct from Didieri; has deep crimson flowers with black base, surrounded with a pure-white band.—*Levier, Tul. Eur.*, t. 2.

49. Fragrans, Munby.—Nearly allied to sylvestris; perfumed; from Algeria.

50. Fulgens.—Tall; large flowers, rosy-crimson, with white centre Chiswick, No. 127.

51. Fulgens lutea pallida.—Pale yellow; very fine.

52. Fulgens striata.—Like the type, but flamed and feathered yellow.

53. Galatica.—Dwarf-growing species; deep yellow, olive-green base. **A.M.** (R.H.S.), May 28, 1900.

54. Gele Kroon (*syn.* Corona lutea).—Soft lemon-yellow, tipped carmine.

55. Generaal Vetter.—Very late, medium-sized flower, pale yellow, passing to a deep rose.

56. Gesneriana, L., type.—Rich scarlet-crimson, with deep blue base. Resembling the more common form G. spathulata, but smaller and shorter shape of flower.

57. Gesneriana albo-cœrulea.—Dwarf; scarlet, dark basal blotch, with white markings.

58. Gesneriana albo-maculata (*syn.* 'Gesneriana Queen Emma').—Light base.

59. Gesneriana aurantiaca (*syn.* 'Spathulata aurantiaca').—Orange-red.

60. Gesneriana aurantiaca maculata (*syn.* 'Spathulata aurantiaca maculata').—Orange-red, with dark basal blotch.

61. Gesneriana ixioides.—Pure yellow, with black centre. **A.M.** (R.H.S.), May 22, 1901.

62. Gesneriana lutea.—Golden yellow, soft primrose-scented.

63. Gesneriana lutea pallida.—Very large, pale yellow.

64. Gesneriana nigro-variegata.—With dark brown flames and feathers.

65. Gesneriana rosea.—Rich rose, with a deep blue base. Chiswick, Nos. 131 and 132.

66. Gesneriana spathulata (*syn.* Gesneriana major).—Rich scarlet-crimson, large deep blue base. Chiswick, No. 133. *Alb. v. Eeden*, t. 94.

67. Gesneriana Stella.—Deep carmine, centre dark blue on white ground.

68. Gesneriana, 'The Nigger.'—Deep crimson, with dark centre.

69. Gold Cup.—Bright yellow, flaked crimson, edged carmine.

70. Golden Eagle.—Rich canary-yellow; slightly fragrant. One of the earliest. Chiswick, No. 136.

71. Gold Flake.—Orange-scarlet, flaked with golden yellow; sweet-scented. Chiswick, No. 137.

72. Gouden Kroon (Golden Crown).—Rich golden yellow, edged orange, which gradually covers the whole flower, giving it a brownish bronze-yellow colour. Chiswick, No. 135.

73. Greigi, Regel.—Bold early flower, dazzling scarlet; foliage spotted brown.—*Gartenflora*, 1873, t. 773; *Bot. Mag.* t. 6,177; *Flore d. S.* 1875, t. 2,261; *Flor. and Pom.* 1876, p. 217; *Garden*, xi. t. 73, and l. t. 1,084; *Lebl. Ill. G. Z.* 1877, t. 34; *Ill. Monatshefte*, 1888, t. 9. **F.C.C.** (R.H.S.) April 18, 1877.

74. Greigi aurea.—Brilliant yellow and scarlet. *Garden*, l. t. 1,084.

75. Hageri, Heldreich.—Small flower; pointed petals; dull red; black basal blotch. Chiswick, No. 138; *Gartenfl.* 1874 t. 790; *Bot. Mag.* t. 6,242; *Belg. Hort.* 1877 t. 2. [This Tulip was dedicated to Mr. Fred Hager, of Athens; the name should be written Hageri, not Haageri].

76. Harlequin.—Red and yellow variegated.

77. Isabella (*syn.* Shandon Bells).—Primrose-yellow flushed with rose, afterwards deep magenta; long form of flower.

78. John Ruskin (*syn.* Gesneriana John Ruskin).—Orange-yellow, shaded pink at edge of petals.

79. Klondyke, in the way of Billietiana.—Yellow, edged scarlet.
80. Kolpakowskiana, Regel.—Yellow, outer segments streaked with

FIG. 341.—TULIPA KOLPAKOWSKIANA (*syn.* BORSZCZOWI). (*Gardeners' Chronicle.*)

red. *Gartenflora*, 1878, t. 951; *Bot. Mag.* t. 6,635; *Gard. Chron.* 1900, i. fig. 99. **A.M.** (R.H.S.) May 8, 1900 (sub T. Borszczowi). (Fig. 341.)

81. Koningskroon.—Bold flower; reddish-brown with regular yellow border, in the same way as the early Tulip Keizerskroon.

82. La Candeur (*syn.* Parisian white, Snowdon).—White, edged and shaded with pink.

83. La Citronnière.—Flower pale lemon-yellow.

84. Lady Roberts.—Blush white, margined rosy carmine. Earlier than Picotee.

85. La Merveille.—A very distinct large flower with long recurving petals; orange-red suffused carmine, deliciously perfumed.

86. La Panachée (*syn.* La Ravissante, Maria de Medicis).—Creamy white, striped cherry-red; leaves variegated.

87. Leghorn Bonnet (*syn.* elegans lutea pallida).—Satiny yellow with a nankeen stripe on the centre of each petal.

88. Leichtlini, Regel.—Small-flowered like Clusiana, inside white, outside coral red. *Garden*, 1891, t. 819, fig. 2. **F.C.C.** (R.H.S.) April 23, 1889.

89. Linifolia, Regel.—Very dwarf; dazzling self scarlet; a perfect gem. *Gartenflora*, t. 1,235.

90. Lord Byron (*syn.* Gesneriana Lord Byron).

91. Lownei, Baker.—A miniature flower; pale rose with clear yellow base.

92. Macrospeila.—Bright scarlet with a dark centre, surrounded clear yellow; sweet-scented. Chiswick, No. 139.

93. Maculata, Baker.—Dwarf; medium-sized flower, rich crimson with dark base, feathered yellow.

94. Maculata Brilliant.—Dwarf and late; dazzling colour. Chiswick, No. 141.

95. Maculata elegans grandiflora.—Another very fine large-flowering form.

96. Maculata globosa grandiflora.—Very large; velvety crimson; deep black base.

97. Maculata globosa nana.—Dwarf; large flowers, crimson with dark base.

98. Maculata major.—Taller than type, flowers nearly the same. Chiswick, No. 140.

99. Maculata The Moor.—Very late; scarlet with black base.

100. Maid of Holland, nearly related to Bridesmaid, but distinguished by a more scarlet-coloured ground colour and yellow markings.

101. Marjolleti.—Pale creamy white, edged cerise; very handsome.

102. Mauriana, Jord. et Fourr.—Brilliant scarlet, yellow base, very effective. **A.M.** (R.H.S.) May 22, 1901.

103. Mrs. Moon (*syn.* fulgens maxima lutea).—Large flower; reflexed petals; pure golden yellow; one of the finest Tulips. *Garden* 1896, May 16, t. 1,066. **A.M.** (R.H.S.) May 23, 1900.

104. Orange Queen.—Medium-sized egg-shaped flower; golden yellow, profusely mottled and marbled with crimson.

105. Orphanidea aurantiaca.—Bright orange-yellow with black base. *Bot. Mag.* t. 6,310.

106. Ostrowskiana, Regel.—Brilliant vermilion scarlet; small black eye; purple anthers. *Gartenflora*, 1884, t. 1,144; *Bot. Mag.* t. 6,710;

Garden, 1891, t. 819, f. 1, and 1894, t. 965, f. 1. **A.M.** (R.H.S.) May 8, 1900 (sub T. Kolpakowskiana).

107. Parisian Yellow (*syn.* Annie).—Pointed petals; pure yellow.

108. Persica (*syn.* Australis, Breyniana).—Leaves undulated; very dwarf; flowers small, yellow, fragrant. Chiswick, No. 145. *Garden*, 1887, ii. t. 627; *Album van. Eeden*, t. 80.

109. Picotee (*syn.* La Vierge, Maiden's Blush).—Pointed petals, reflexed and elegant, pure white, crimson border. Chiswick, Nos. 146 and 142. *Garden*, 1895, t. 1,085, f. 2; *Floril. Haarl.* t. 59, f. 1.

110. Picotee.—[The form supposed to be the true old English Picotee. No. 109 now being generally cultivated and sold as Picotee, it was proposed to rename No. 110.]

111. Planifolia, Jord.—From Savoy. Deep red with dark basal blotch.

112. Platystigma, Jord.—Pointed petals; rose suffused with orange towards the margins. Parrot and other late Tulips revert to it. Chiswick, No. 147.

113. Platystigma variegata.—Rose, feathered and flamed sulphur.

114. Primrose (*syn.* Beauty of Lisse).—Pale yellow self.

115. Primulina.—Very dwarf; miniature flower; cream colour. *Bot. Mag.* t. 6,786.

116. Retroflexa.—Recurving petals, pure yellow. Chiswick, No. 148. *Album van Eeden*, t. 80; *Garden*, 1887, t. 625.

117. Rosalind (*syn.* Gesneriana albo-oculata).—Rosy crimson with pure white base; medium-sized flower, very lovely.

118. Rose Mignon.—Rose, flaked creamy white.

119. Rose Mignon.—With variegated leaves.

120. Royal White.—Large flower, pure white.

120*a*. Salmon Queen (*syn.* Gesneriana Salmon Queen).—Salmon-orange.

121. Saxatilis, Sieber.—Medium-sized flower of a lovely rosy lilac shade, with yellow base. *Reich. Ic. Crit.* t. 396; *Bot. Mag.* t. 6,374; *Garden*, 1899, t. 1,284. **A.M.** (R.H.S.) May 5, 1896.

122. Shakespeare.—Scarlet; shape of Gesneriana forms.

123. Silver Queen.—A sport from Isabella, with paler edges.

124. Strangulata primulina.—Pale sulphury-yellow with dark base.

125. Strangulata variopicta, Reboul.—Yellow, outside brownish, with dark base.

126. Striped Beauty (*syn.* Lommerlust, Zomerschoon *false*, Summer Beauty).—Deep rose, flaked white and crimson.

127. Sunset (*syn.* Billietiana Sunset).—Long pointed petals, orange-yellow, edged and flaked orange-scarlet, dark centre. Chiswick, No. 115.

128. Sweet Nancy (*syn.* Narbonensis alba).—White, delicately edged with pink. Chiswick, Nos. 149 and 143.

129. Sylvestris major.—Long pointed petals, yellow, sweet-scented; stems slender.

130. Tempelier.—Yellow, edged red, black base.

131. The Fawn (*syn.* Gesneriana The Fawn).—Egg-shaped flower, fawn or dove colour.

132. Thirkeana, C. Koch.—Pale yellow, small-flowered species.

133. Triphylla, Regel.—Dwarf, small-flowered species, yellow, outside greenish. *Gartenfl.* t. 942.

134. Virginalis.—Pointed petals, white, margined with rosy-crimson. Chiswick, No. 153.

135. Viridiflora.—Green, with a broad margin of dull yellow. Chiswick, No. 154. *Album van Eeden,* t. 80.

136. Viridiflora præcox.—Earlier; much larger and paler than the type. Chiswick, No. 155. *Garden,* 1887, t. 625.

137. Viridiflora tardiva.—Later than type; flowers entirely dull green.

138. Vitellina.—Beautiful flowers of pale sulphury-yellow. Chiswick, No. 156. *Garden,* 1889, ii. t. 730. **A.M.** (R.H.S.) May 5, 1896.

139. Wilsoniana.—New species; brilliant blood-red. *Gard. Chron.* 1901, i. fig. 121.

140. Yellow Picotee.—A yellow sport of Picotee; yellow, feathered red.

141. Yellow Queen (*syn.* Golden Queen).—Large loose flowers, orange-yellow, very fine.

142. York and Lancaster.—A sport from Isabella; same shape; colour lighter.

143. Zomerschoon.—True; an old Dutch amateur Tulip; large long-petalled flower; clear rosy-red, with sulphur-yellow markings and flames. Quite distinct from Striped Beauty.

SYNONYMS.

Annie.—See No. 107, Parisian Yellow.
Australis.—See No. 108, Persica.
Beauty of Lisse.—See No. 114, Primrose.
Biebersteiniana *false*.—See No. 10, Billietiana nana.
Billietiana Cloth of Gold.—See No. 22, Cloth of Gold.
Billietiana Sunset.—See No. 127, Sunset.
Bonte Zwaan.—See No. 33, Dame élégante.
Breyniana.—See No. 108, Persica.
Cornuta.—See No. 1, Acuminata.
Corona lutea.—See No. 54, Gele Kroon.
Elegans lutea pallida.—See No. 87, Leghorn Bonnet.
French Crown.—See No. 24, Columbus.
Fulgens maxima lutea.—See No. 103, Mrs. Moon.
Gala Beauty.—See No. 24, Columbus.
Gesneriana albo-oculata.—See No. 117, Rosalind.
Gesneriana John Ruskin.—See No. 78, John Ruskin.
Gesneriana Lord Byron.—See No. 90, Lord Byron.
Gesneriana Major.—See No. 66, Gesneriana spathulata.
Gesneriana Queen Emma.—See No. 58, Gesneriana albo-maculata.
Gesneriana Salmon Queen.—See No. 120A, Salmon Queen.
Gesneriana spathulata aurantiaca.—See No. 59, Gesneriana aurantiaca.

Gesneriana spathulata aurantiaca maculata.—See No. 60, Gesneriana aurantiaca maculata.

Gesneriana striata.—See No. 13, Bridesmaid.

Gesneriana The Fawn.—See No. 131, The Fawn.

Golden Queen.—See No. 141, Yellow Queen.

Ida.—See No. 12, Bouton d'Or.

La Ravissante.—See No. 86, La Panachée.

Lommerlust.—See 126, Striped Beauty.

Lutea.—See No. 12, Bouton d'Or.

Maria de Medicis.—See No. 86, La Panachée.

Narbonensis alba.—See No. 128, Sweet Nancy.

Parisian White.—See No. 82, La Candeur.

Shandon Bells.—See No. 77, Isabella.

Snowdon.—See No. 82, La Candeur.

Stenopetala.—See No. 1, Acuminata.

Summer Beauty.—See No. 126, Striped Beauty.

Zomerschoon *false*.—See No. 126, Striped Beauty.

FIG. 342.—TULIPA BILLIETIANA (Reduced).

FRUIT DRYING AND EVAPORATING.

In August 1890 a most valuable lecture was delivered before the Royal Horticultural Society by Mr. E. W. Badger on "American Fruit Evaporators," which will be found at page 582 of vol. xii. of our Journal. In it he describes various different patterns of evaporators, and also gives from Dr. Symons, of Arkansas, the points to be obtained by evaporation. Mr. Badger also touches, but somewhat briefly, the crucial question, Will it yield a commercial profit in this country, as it undoubtedly does in America?

One result of this lecture, which excited the greatest interest all over the country, was that an evaporator was presented to the Society by Messrs. Mayfarth, which was worked for two or three seasons at Chiswick, and when the produce was shown at one of the autumn meetings in 1892 it was considered to be of such excellent quality that a Silver-gilt Medal was awarded to Messrs. Mayfarth as an expression of the great satisfaction felt in the results their machine had achieved. Mr. A. F. Barron, in his report to the Fruit Committee, said that Apples required a temperature of 175 degs. to 200 degs., maintained for three hours; and Plums 250 degs., for from eight to ten hours; and it was found that the thicker the skin of the Plum the more satisfactory was the dried produce, varieties with thin and delicate skins often bursting and becoming messy.

Roughly speaking it was found that one bushel of Apples produced 6½ lb. of dried rings, and that 1 lb. of coal is expended for every 1 lb. of dried fruit.

Of more recent information, we may quote Mr. James Harper, of Stroud, who tells us in the *Gardeners' Chronicle* for September 21, 1901, that he can buy any quantity of the finest Plums at 5*s*. 6*d*. a cwt. The Plums lose about three-quarters of their weight in drying, and therefore would cost him when dried at the rate of 2½*d*. a lb., or 22*s*. a cwt. He reckons the cost of drying at 1*d*. a lb., so that the total cost to the producer would be 3½*d*. a lb.

If these figures are only approximately correct, it is evident that Plums can be profitably dried in this country for the producer's own consumption at least. Whether they could be profitably put into commerce is another question, as this involves packing, transit, and retailers' profits before the producer's profit comes into view. But putting the initial cost of the fruit and its drying at 4*d*. a lb., and allowing 1*d*. for packing and transit, and another 1*d*. (too little we fear) for retailers' profits, experience only could prove whether the produce would sell freely at a price so much higher than the 6*d*. a lb. thus arrrived at as to provide an encouraging profit to the producer.

Speaking at a meeting at Paignton quite recently, Mr. Harper said that when Plums were so ripe as to be no longer fit to travel they might be put into the evaporator, filling the trays from the top, where there is the least heat, and bringing them gradually down to the bottom, where

the heat is the greatest. They must be turned about several times for twelve to sixteen hours, according to the quality of the Plums, and he reckoned the profit as something considerable. Damsons he said he had bought at 5*s*. a cwt. They cost very little to dry, and he sold them at 4½*d*. a lb. Now, even supposing them to have lost three-quarters of their weight in drying, he would still have left out of each cwt. of raw fruit 28 lb. of dried, and this at 4½*d*. a lb. would produce 10*s*. 6*d*., or rather more than double the cost of his raw fruit.

On October 29 Mr. James Udale, Instructor in Horticulture to the County Council of Worcestershire, exhibited at the Drill Hall a very remarkable collection of dried fruits, vegetables, and herbs. Opinions, of course, always differ on the subjects of flavour and taste. Some people still prefer the mawkish jet-black French Plums in bottles, which taste as if they had been dipped in treacle, to the sub-acid Californian ones to be had in boxes; and those same people would still more prefer their favourite French fruits, which seem to us so absolutely devoid of flavour, to Mr. Udale's fruit, which was as full of fruit-acid and flavour as the day it was picked off the tree. Opinion on these matters of taste will differ, but for ourselves we know we never buy a French as long as we can get a Californian Plum; and though we have not tasted them cooked, we feel pretty sure we should prefer Mr. Udale's as much to the Californian fruit as we do that to the French.

The following are lists of the dried fruits and vegetables shown on that occasion by Mr. Udale, who informed us that the machine with which he worked was the smallest of the Ryder patent type, and the average consumption of coal 88 lb. in every twenty-four hours, but a larger machine would, he thought, prove very much more economical.

Specimens of Evaporated Fruits, &c., Exhibited at the Drill Hall, October 29, 1901.

I.—Plums, Damsons, and Cherries.

Name	Fresh Weight	Dry Weight	Temperature average	Average time in Drying
Plums	lb.	lb. oz.	deg.	hours
White Perdrigon . .	98	27 4	190–220	16
Victoria . . .	102	25 12	190–220	18
*Pershore . . .	80	15 4	160–220	16
Red Magnum Bonum .	36	8 0	180–200	12
Bittern . . .	16	4 0	140–180	10
Czar	9	3 0	180–210	12
*Greengage (July) .	10	2 0	180–210	11½
Curlew	8	1 8	140–180	9
Prince Engelbert . .	10	2 8	160–200	14
Diamond . . .	20	4 0	160–200	16
Cox's Emperor . .	11	2 4	220–240	16
Monarch . . .	10	2 8	200–230	15
Damsons				
Common Damson .	135	35 0	160–200	6
Farleigh Prolific . .	37	11 4	160–200	7
Morello Cherries .	6	1 14	160–200	1

Easily crack their skins.

II.—Apple Slices.

Name	Fresh Weight	Dry Weight	Temperature average	Average time in Drying
	lb.	lb. oz.	deg.	hours
Cellini	10	13	150–200	6
Bramley's Seedling .	7	12	180–210	5
(a) Lane's Prince Albert	10	12	180–210	5
(a) New Hawthornden .	14	1 2	180–200	4
(a) Ringer . . .	24	2 2	180–220	3½
Lord Suffield . .	12	1 2	200–210	3½
(a) Ecklinville . .	28	2 2	200–210	4
Lord Grosvenor .	9	1 0	200–210	4
(a) small fruit.				

III.—Whole Apples.

Cellini . . .	8	1 12	180–200	18
(b) New Hawthornden .	10	2 8	180–200	12
(b) Lane's Prince Albert	10	2 4	180–200	12
(b) Greenup's Pippin .	12	4 0	230–250	7
(b) very small fruit .				

IV.—Pears.

Williams' Bon Chrétien	20	3 10	200–240	9
Beurré d'Amanlis . .	10	2 0	200–240	9

V.—Vegetables.

Sliced Runner Beans				
Neal's Ne Plus Ultra .	20	1 10	130–140	6
,, ,, ,, ,, .	10	0 14	200–240	4
Cauliflower				
4 Autumn Giant . .	—	—	200–220	—
Potatos (sliced)				
Sharpe's Victor . .	10	2 0	220–240	6½
,, Ringleader .	10	2 6	220–240	4

VI.—Herbs.

Marjoram . . .	—	—	130–140	45 min.
Mint	—	—	130–140	50 ,,
Savory	—	—	130–140	55 ,,
Thyme	—	—	130–140	60 ,,
Sage	—	—	130–140	75 ,,
Parsley	—	—	130–140	90 ,,

Since he exhibited at the Drill Hall, Mr. Udale has made a most valuable Official Report to his County Council, who have kindly allowed us to reprint it at the end of this summary:

Report on Experiments in Fruit and Vegetable Drying at the Experimental Garden, Droitwich, 1901.

To the Chairman of the Agricultural Sub-Committee of the Worcestershire County Council.

Sir,—

In accordance with instructions received from your Committee, I have, during the months of September and October of the current year, carried out certain experiments in drying Fruit, Vegetables, and Herbs, by means of a Number 0 (Dr. Ryder's Patent) Invicta Evaporator,

supplied by Messrs. Lumley & Co., The Minories, London, E.C. Twenty trays were supplied with it, and the catalogue price is £11. 10s., plus an advance of 10 per cent.

This Evaporator is, in my opinion, too small for commercial purposes, because it requires as much attention—and in respect to the regulation of temperature more care—as one with three or four times its capacity. It is also very wasteful with fuel; because the Evaporator consists of only one short flue or air-chamber, through which the hot air rushes immediately into the atmosphere and is lost. For these two reasons the cost of labour and fuel is unnecessarily great, and the cost of the dried article much higher than it would be with an Evaporator of larger capacity.

In conducting the experiments I sought to ascertain: (1) the best varieties for drying for commercial purposes; (2) the average time required to dry the respective varieties at known average temperatures; (3) the average loss in weight between the undried and the dried article; (4) the average consumption of fuel during twenty-four hours of continuous work; and (5) the capacity of the Evaporator in drying a given quantity of Damsons in the shortest space of time.

Plums.

The varieties of Plums tested were: Bittern, Czar, Curlew, Cox's Emperor, Diamond, July Greengage, Monarch, Pershore, Prince Engelbert, Red Magnum Bonum, Victoria, White Perdrigon; and of Damsons, Farleigh Prolific and the Shropshire Damson.

Of the twelve varieties of Plums dried, the following gave the best results in regard to the *weight* of the dried product:—

Czar	gave	33	per cent. of dried fruit.
White Perdrigon . .	,,	27	,, ,, ,, ,, ,,
Victoria . . .	,,	25	,, ,, ,, ,, ,,
Monarch . . .	,,	25	,, ,, ,, ,, ,,
Prince Engelbert .	,,	25	,, ,, ,, ,, ,,
Red Magnum Bonum	,,	22	,, ,, ,, ,, ,,
Cox's Emperor . .	,,	20	,, ,, ,, ,, ,,
July Greengage . .	,,	20	,, ,, ,, ,, ,,
Pershore . . .	,,	19	,, ,, ,, ,, ,,

The best varieties in *appearance* are Monarch, Prince Engelbert, Czar, Victoria, and White Perdrigon, in the order named. These are followed by Red Magnum Bonum, Cox's Emperor, and Pershore.

The average time and temperature required by the better varieties to dry were as follows:—

Monarch	200–230° F.	15 hours.
Prince Engelbert . .	160–200	14 ,,
Czar	180–210	12 ,,
White Perdrigon . .	190–220	16 ,,
Victoria	,, ,,	18 ,,
Red Magnum Bonum .	180–200	12 ,,
Cox's Emperor . . .	220–240	16 ,,
Pershore	160–220	16 ,,

The two varieties of Damsons dried nicely, and kept their colour and flavour.

Farleigh Prolific	yielded 33 per cent.	of dried fruit.
Shropshire Damson	„ 25 „ „	„ „ „

The average time required by the Damsons for drying was six hours for the Shropshire variety and seven hours for Farleigh Prolific, the temperature in each case being 160–200° F.

Continuous Drying.

The time required to dry the whole of the 135 lb. of Shropshire Damsons was 54 hours of continuous drying; and the fuel consumed during that period was $1\frac{3}{4}$ cwt. of good house-coal, costing one shilling and twopence per cwt.

As fruit-drying is very suitable work for females, I charge for labour an average of 2*s.* per day; and taking that as a basis of payment for labour, the cost of the dried product—after allowing three shillings per bushel of 80 lb. for the fresh fruit, the price I actually paid for them—is $4\frac{1}{2}$*d.* per pound. I have already stated that a larger machine would dry a much larger quantity of fruit for the same cost in labour and fuel, and I think the cost of production would be reduced to about one-half, allowing 3*s.* per 80 lb. as the value of the undried Damsons.

The cost of the dried Victoria, Monarch, Perdrigon, and Cox's Emperor was 4*d.* to $4\frac{1}{4}$*d.* per pound, as calculated on the above basis, and charging market prices for the fresh fruit, as actually received from salesmen.

The surplus Plums and Damsons have been sold *wholesale* and realised the following prices:—

Best Victoria	6*d.* *per lb.*
„ Perdrigon	6*d.* „
Second Victoria	$4\frac{3}{4}$*d.* „
„ Perdrigon . . .	$4\frac{3}{4}$*d.* „
Pershore	$4\frac{1}{2}$*d.* „
Damsons	$4\frac{1}{2}$*d.* „

Apples and Pears.

Experiments were made in drying Apples and Pears: the former whole and in slices, the latter peeled and cored and cut in halves.

Four varieties of Apples were dried whole, viz.: Cellini, New Hawthornden, Lane's Prince Albert, and Greenup's Pippin. The first were dried as gathered from the tree; the three latter were small fruit only, or third size. The results were as follow:—

		lb.	oz.	
8 lb. Fresh Fruit of Cellini	gave	1	12	dried product.
10 „ „ „ „ New Hawthornden	„	2	8	„ „
10 „ „ „ „ Lane's Prince Albert	„	2	4	„ „
12 „ „ „ „ Greenup's Pippin	„	4	0	„ „

The small fruit dried in from 7 to 12 hours; the larger fruit of Cellini required about 18 hours. Those dried in 7 hours were subjected to a temperature of 220–250° F.; the others were in a temperature of 180–200° F.

Apple Slices.

Eight varieties of Apples were peeled, cored, and sliced. They were:—Cellini, Bramley's Seedling, *Ecklinville, *Ringer, Lord Suffield, Lord Grosvenor, *Lane's Prince Albert, and *New Hawthornden. Those marked with an asterisk were small Apples only; the others were large and small as gathered from the trees.

The best results were obtained from Bramley's Seedling, Lord Grosvenor, Lord Suffield, and Ringer in their order of merit; followed in the same order by Cellini, New Hawthornden, Ecklinville, and Lane's Prince Albert. The average result obtained from the eight varieties gave 15 ounces of dried product from 11 pounds of fresh fruit. The weight of the dried article is misleading; because, although the above is the actual weight when the slices, &c., are removed from the Evaporator, the dried product absorbs atmospheric moisture, and in a few days the weight is considerably increased; but I have not taken note of the actual increase, much depending upon atmospheric conditions.

Pears.

Two varieties of Pears were tried:—Williams' Bon Chrétien and Beurré d'Amanlis They were peeled by the peeling machine, and cut in halves and cored by hand. They dried in nine hours in a temperature of 200–240.°

	lb.	oz.	
10 pounds of fresh Beurré d'Amanlis gave	2	0	dried product.
20 " " " Williams' Bon Chrétien	3	10	" "

Morello Cherries.

Six pounds of Cherries were dried and gave 1 lb. 14 oz. of dried fruit. They dried in 12 hours in a temperature of 160–200°.

Vegetables and Herbs.

Potatos.

Sharpe's Victor and Sutton's Ringleader were peeled and sliced, and dried in a temperature of 220–240° F. They lost about four-fifths of their weight in drying, and took an average of 5 hours in the process.

Cauliflower

dried successfully, and may be of commercial value for export purposes; but unnecessary at home.

Runner or Kidney Beans.

The above were sliced by a slicing machine and then dried. Thirty pounds of Beans gave two-and-a-half pounds of the dried article when weighed immediately after drying; but these absorb atmospheric moisture in due course and increase in weight.

One portion dried in 4 hours in a temperature of 200–240°; the other portions were 6 hours drying in a temperature of 130–140°.

Herbs.

Parsley, Sage, Mint, Thyme, Savory, and Marjoram were dried. The Sage and Parsley retained their fresh colour, but the others became dull, as when dried in the ordinary way.

They were subjected to a temperature of 130–140° and dried in the following times:—Marjoram dried in 45 minutes, Mint in 50, Savory in 55, Thyme in 60, Sage in 75, and Parsley in 90 minutes.

The lessons learnt from the experiments are:—

1. Ripe fruit dries more quickly than unripe fruit: the latter is several hours longer in the process, and is therefore more costly to produce.

2. Unripe fruit loses a larger percentage in weight during the drying process, and is not a good colour for its kind or variety when dried.

3. Large fruit of the respective kind or variety produces the finest dried article of the same variety or kind.

4. Small specimens of the same variety of fruit or vegetable dry more quickly than larger specimens.

5. Stone fruit, such as Plums, Cherries, &c., should be exposed to a low temperature at first for several hours, and have the temperature gradually increased as evaporation proceeds.

6. Apples and Vegetables may be exposed at once to a moderately high temperature, and finished in a lower temperature.

7. Stone fruit should be placed on the trays with the stalk-ends uppermost.

8. Fruit of equal size should be placed upon the same tray, and not small mixed with large fruit.

9. Apples and Pears should be immersed in a weak solution of salt and water *immediately* after peeling: one ounce of salt to three quarts of water; if left exposed to the air after being peeled they quickly become discoloured.

General Remarks.

I think there is a prospect of Plum-drying becoming an industry in this country; and that in years of great abundance of fruit and of very low, or no, prices, the fruit may be dried and sold wholesale at remunerative prices. Clearly we have varieties which are at once prolific and suitable for drying: notably Monarch, Czar, Prince Engelbert, White Perdrigon, and Victoria.

I think it is tolerably safe to say that each of the varieties mentioned is worth, for drying purposes, from 3*s*. per bushel upwards.

The operation of preparing and drying Fruit and Vegetables is soon learnt by any intelligent man or woman; and I think it is labour well adapted for women.

If 5*s*. and upwards can be obtained per hundredweight for good Apples, I think it will be best to sell them in the undried state. Perhaps small Apples will pay for drying; and they might also be remunerative for making into jelly.

Although we have made jelly from the peelings and corings of Apples and Pears—that "nothing be wasted"—I fear that the balance would

be on the wrong side of the ledger if a strict debtor and creditor account had been kept.

We have demonstrated that all kinds of Vegetables may be dried successfully—from Pot Herbs to Cauliflowers—but we have not tested them sufficiently extensively to be able to say if, or how far, they could be dried with commercial success.

I have tested the eating qualities of the second-grade Victoria Plums (I thought if the second-grade were good, the first-grade would be better) after gentle stewing for thirty minutes, with the addition of a little lump sugar, and I was more than satisfied with their quality. They were clean and delicious, and superior to any French Plums I have bought at any time at 6*d.* per lb. retail. I selected the Victoria for the test, because it has been condemned as unsuitable for drying by a certain writer for the Horticultural Press, and because I know the better varieties can take care of themselves.

Although it may be admitted that—so far as our experiments have gone—the best varieties for drying at home are Monarch, Prince Engelbert, and Czar, and that they now realise remunerative prices when sold undried, we cannot be certain that they will be so remunerative five years hence, or even three years hence.

Monarch and Czar are being extensively planted, and we may have such abundant supplies of those—and of others as good—in the near future, that the prices realised for them may fall to a comparatively unremunerative amount in the fresh state; then the grower may dry them, and profit thereby.

Samples of French and Californian dried Plums have been bought at 10*d.* and 6*d.* per lb. respectively, for comparison with the home-grown and home-dried Plums, and the following are the results:—

Competent judges are agreed that in appearance—

The Monarch	surpassed the	French	at 10*d.*	per lb.
Prince Engelbert	,,	,,	,, 6*d.*	,,
Victoria White Perdrigon Czar	,,	Californian	,, 6*d.*	,,

and that their quality in order of merit when stewed gently for thirty minutes is as follows:—

1, White Perdrigon; 2, Victoria; 3, French at 10*d.* per lb.; 4, Californian, at 6*d.* per lb.; 5, French, at 6*d.* per lb.; 6, Pershore.

The tenderness of the skins *before* stewing varied in the following order:—1, French at 10*d.*; 2, Victoria; 3, Pershore; 4, White Perdrigon; 5, Californian and French at 6*d.*

Two Silver Medals and a Bronze Medal have been awarded to the samples of Dried Fruit and Vegetables by the Royal Horticultural Society, Birmingham and Midland Counties' Chrysanthemum, Fruit, and Floral Society, and the Tamworth Chrysanthemum and Fruit Society.

I am, Sir,

Your obedient Servant,

JAMES UDALE.

THE ARRANGEMENT OF THE AIR-CANALS IN THE STALKS OF NYMPHÆAS.

By Dr. Maxwell T. Masters, F.R.S.

(*Read before the Scientific Committee, February* 11, 1902.)

Many years ago I had the opportunity of studying the Nymphæas grown by the late Mr. Baxter in the Botanic Garden, Oxford. I soon found that the arrangement of the air-canals which traverse the leaf-stalks and the flower-stalks from end to end was sufficiently constant to allow of the species in the different sections being grouped according to the various ways in which the canals were disposed. A communication on the subject was made to the Botanical Section of the British Association in 1854, and a brief abstract was published in the Report of the Association for that year, Part 2, p. 102. See also *Gardeners' Chronicle*, 1856, p. 358.

Illustrations of the various methods of arrangement were obtained by dabbing the cut ends of the stalks on to a pad of blotting-paper saturated with ink, and then pressing them lightly on to paper, a plan suggested to me by Mr. W. Baxter, sen. By these means an exact representation of the arrangement of the larger canals can easily be obtained. The smaller canals and those which encircle the larger central tubes are not so characteristic, and may for the present purpose be passed over. A series of such impressions made by me at the time, including nearly all the species then in cultivation, may be seen among the collection of drawings in the Herbarium at Kew.

Botanists and those who have compiled monographs of the order have paid little or no heed to the disposition of the canals, probably because they think it less constant than it really is, or because the canals are not readily visible in dried specimens, whilst living ones are not always at their disposal.

In the communication to which I have referred the species are thrown into primary groups according as the arrangement of the air-tubes is alike in the leaf-stalk and in the flower-stalk respectively, or as the disposition of the canals is different in those organs. Subsidiary groups are founded on the particular differences observable in the arrangement of the tubes in each species.

In the first group are included *N. tuberosa, odorata, minor, alba, nitida,* and *pygmæa*, in all of which the arrangement of the air-tubes is nearly alike, if not identical, in petiole and peduncle. Further experience leads me to attach less importance to this group than formerly. In both petiole and peduncle are four principal canals, placed side by side and surrounded by smaller ones. To these may now be added *Laydekeri fulgens* and *caroliniana*.

In the second group, the air-canals in the petioles are arranged in the same manner as those in the preceding section, but in the peduncle the larger canals are arranged round the centre in a radiating manner. These

are encircled by one or more rows of smaller tubes, each row generally containing twice as many tubes as that immediately interior to it. As illustrations of this group may be mentioned *N. cærulea, cyanea, scutifolia, guineensis, blanda, ampla, mexicana, amazonum, micrantha, stellata*, and sometimes *tuberosa* and *alba*, &c.

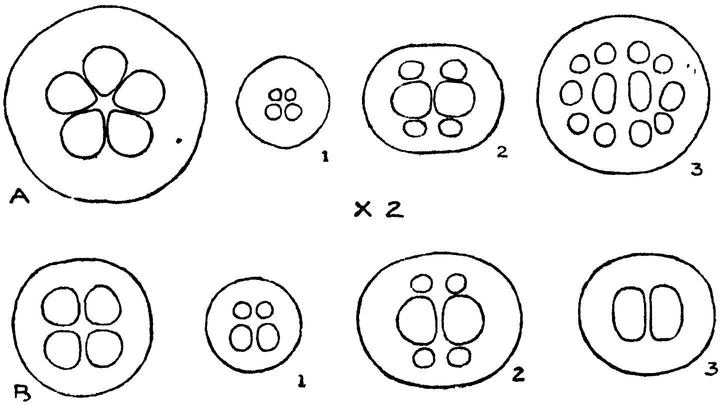
FIG. 343.—NYMPHÆA DEVONIENSIS, of the Lotus section, with two large air-canals in the leaf-stalk and four smaller ones, and with six large canals in the flower-stalk radiating from the centre; 2, stamen; 3, stigmas. (From *Bot. Mag.* tab. 4,665.)

The third group includes the Lotus section, comprising *N. Lotus, dentata, devoniensis*, &c., characterised by the presence of two relatively very large air-canals in the leaf-stalk, whilst those of the flower-stalk radiate from the centre as in the Cyanea section, and several of M. Latour-Marliac's finest hybrids. (Fig. 343.)

The introduction of numerous beautiful hybrids by M. Latour-Marliac directed my attention to the subject again, and, with a view to ascertain how far my early observations applied to the new introductions, I sought the assistance of Mr. Hudson. That gentleman has made a special feature of the cultivation of these plants in Mr. de Rothschild's garden at Gunnersbury, and he very kindly supplied me with numerous specimens which have furnished the basis for the present communication. As, owing to the lateness of the season, perfect leaves and flowers were not always forthcoming, but only the stalks, it is possible that there may be some confusion in the nomenclature of particular specimens which may account for discrepancies; moreover, the exact parentage of M. Latour-Marliac's hybrids is not known in all cases; nevertheless the arrangement of their air-canals presents the same general modifications as I had previously observed.

A simpler plan of grouping than that previously adopted may be arrived at by making two primary groups founded on the arrangement of the canals in the flower-stalk. In all instances it will be found that the larger air-canals in the peduncle or flower-stalk are arranged either in a radiating manner round the axis of the stalk, or that they are placed in pairs side by side. Minor subdivisions in each group may be established in accordance with the varying arrangements of the tubes in the petiole or leaf-stalk. The disposition of the smaller canals is less regular, and for the present purpose may be disregarded.

The arrangement now proposed is the following, and is illustrated in the accompanying diagram:—



A. Peduncle with five to six nearly equal canals radiating from the centre.

1. Petioles with four central canals, two large, two small: *gloriosa, Laydekeri lilacea, stellata, micrantha, cyanea, Marliacea rosea, tuberosa* (sometimes) (as in A 1).
2. Petioles with six central canals, two median large, four much smaller: *Seigneureti, Robinsoniana, Andreana, Marliacea chromatella, lucida, gigantea* (as in A 2).
3. Petioles with two very large central canals: *Lotus, dentata, rubra, devoniensis* (as in B 3).

4. Petioles with numerous irregularly disposed canals: *tuberosa* (sometimes), *alba* (as in A 3).

B. Peduncular air-canals, four, in collateral pairs.

1. Petioles with four central canals, two large, two smaller (as in B 1): *odorata rosea, o. exquisita, o. sulphurea, Laydekeri fulgens, sanguinea, pygmæa helvola, carolina perfecta, c. nivea.*
2. Petioles with six central canals, two median large, four smaller (as in B 2): *Ellisiana, lucida, Marliacea chromatella, Aurora* (A 2, B 2).
3. Petiole with two central canals much larger than the rest (as in B 3): *Laydekeri rosea, Marliacea.*

In using this table, full allowance must be made for occasional variations and for the fact that, by rare exception, a particular form might as well be placed in more than one group or in some other group than that in which it is here included. This is specially noticeable in *N. alba* and *N. tuberosa.* The hybrid origin of many of the forms is also a possible source of confusion. But after making full allowance for variation and difference of interpretation it will still be found that the arrangement of the air-canals furnishes useful means of discrimination.

The purport of these canals in conferring lightness with economy of structural material is obvious. Not so clear are the functions of the hairs which so often project from the walls of these tubes. Some are simple, others variously branched, and form beautiful objects under a low power of the microscope.

PRELIMINARY REPORT ON THE NATURE OF THE BANANA DISEASE PREVALENT AT ALEXANDRIA.

By Dr. Looss and G. P. Foaden.

Some time since a short report on the external symptoms and probable cause of the Banana disease prevalent near Alexandria was communicated to the Scientific Committee on December 17, 1901, by Dr. Preyer (*see* p. ccxxii).

In December the writers, at the request of the Alexandria Municipality, visited an infected plantation at Gabarri, where the disease was evidently causing great havoc. In addition to this examination on the spot, portions of leaves, stems, roots, &c., were taken for microscopic examination.

The description given by Dr. Preyer in the article previously referred to correctly describes the external symptoms of the disease, and microscopic examinations also indicate that his conclusions were correct as far as they went. It is clear that parasitic worms, if they are not absolutely and entirely the cause of the disease, at least play by far the most important *rôle* in bringing it about. They live chiefly in the roots, for on examining the rootlets some little distance from the parent plant it was found that a considerable number of them had died off and were in a state of putrefaction, while others which were still living showed the knobby appearance mentioned by Dr. Preyer; others again were apparently healthy. On removing the finer particles of earth adhering to the latter their surfaces were seen to be covered with numerous dark dots. These proved to be the places where the youngest terminal offshoots of the roots branch off from the main rootlets. Some of them were still found in connection with the latter, but almost all were in different stages of decomposition, this evidently starting from the base of the offshoots and eventually leading to their death and disappearance.

The conclusions which follow have been derived from an examination of these three different aspects of the roots, but the whole trunk of a very diseased plant was also examined together with the entire root system. These main branches of the root did not show, in this case, the knobbed appearance referred to; a few showed the dotted appearance, but the majority were dead. The number of worms present was considerably fewer than in the secondary roots. As far as an opinion can be expressed on evidence before us, it appears that the secondary roots are particularly singled out for attack, and, becoming finally destroyed, the food supply of the plant is partially cut off, the circulation of the sap is retarded, growth checked, and the external symptoms observed and described by Dr. Preyer are the natural consequence. Where putrefaction is going on other minute forms of life are found, and, owing to the favourable conditions present, multiply at an enormous rate. There were found in the plants examined several species in great numbers of *Rotatoria* and *Infusoria*, but all these animals, in spite of their numbers, have nothing to do with

the cause of the disease, their presence being exclusively a resulting consequence.

Microscopic examinations of the roots with the knobbed appearance showed the presence of so-called egg-sacs. To one acquainted with the history of parasitic worms, this fact in itself is sufficient evidence that a species of nematode was present. The so-called egg-sacs are full-grown females, whose bodies are so strangely swollen as to attain a sac or pear shape and are thus quite incapable of locomotion. Inside the motionless sac the ova of the worm are found in different stages of development. Of this genus (*Heterodera*) three species have hitherto been known. One of them, *H. Schachti* (Schmidt), lives on sugar-beet, having some twenty years ago caused great damage to the beet crop of Germany; a second, *H. exigua* (*Meloidogyne exigua* Goldi), infests the roots of the Coffee plant, having caused great havoc during the years 1885–1888, completely destroying plantations in large districts in Brazil. The history of the latter is very interesting and instructive, inasmuch as the disease could be traced back to 1869: that is to say, sixteen years before the outbreak became really serious. Nothing was known of the pest, nor were any attempts made to cope with it, until the year 1887, when an area of about 715,000 feddans was infected and the cultivation of Coffee rendered impossible. The similarity to the present case is striking. It has been known for some three or four years that a Banana disease existed in the district around Alexandria. The disease was first located in a small area, then at some little distance from the first observed area, and finally has now spread in the whole neighbourhood, not only infecting plantations, but having found its way into private gardens.

The third species known, *H. radicicola* (Müller), is the most interesting because it is known to attack the roots of Bananas. About 1880 some specimens of *Musa Lacca* and *Musa rosacea*, cultivated in the botanic gardens of the University of Berlin, showed signs of disease and it was decided to transplant them. During this process, the strange knobbed appearance of the finer roots was noticed, and microscopic examinations showed the worms to be present, and their evolutions were studied. It appeared that the ova contained in the egg-sacs or cysts in the adult and immobile females, after having developed and left their egg-shells, escape from their parent. The latter then gradually dies. The worms then make their way through the tissues of the root and enter the soil. They wander about here for some time, growing slowly until they find another root into which they enter, thus transferring the disease from one root to another. Once within a new root they grow rapidly to sexual maturity, and after impregnation the female develops into the original egg-sac or cyst. Such is the life-history of *H. radicicola*, and by analogy it is extremely probable that the species of *Heterodera* infecting Egyptian Bananas is very similar, although the species itself is not *H. radicicola*. This latter possesses within its mouth-cavity a very fine, sharp protrusive boring dart, which apparently serves to pierce the walls of the tissue of the root and thus facilitate the entrance of the worms. In the species found in Egyptian plants this is wanting, thus indicating that the species is not identical.

In the case of the disease found in Alexandria matters are complicated

by the presence of at least one other species of parasitic nematode. It has already been stated that the ova of *Heterodera* are as a rule enclosed in the body of the female parent, the cyst or egg-sac.

The microscopic examination of the specimens first taken of the roots showed, in both the knobbed and the dotted rootlets, the presence of nematode ova differing in shape and especially in size from those of *H. radicicola*. They were also irregularly scattered through the tissues of the root, being accumulated in small numbers in some places, in large numbers in others, and sometimes were found in single specimens. It appears that these ova cannot be derived from the pear-shaped and motionless worms, but must belong to a species the adult females of which are wandering freely within the root, depositing their eggs gradually as they wander about. No trace, however, was found of the females themselves; whereas the larvæ already hatched from their eggs, and clearly differing in size and shape from those of the first species (*H. radicicola*), were found both within the roots and outside in the earth adhering to their surfaces.

In the latter case they were sometimes considerable in number, and they showed signs of advanced growth. They were of various sizes, the most advanced showing the first signs of genital organs, preserving, however, at the same time, their original shape, viz. a blunt, almost rounded tail, and a fine sharp dart within the mouth-cavity. From the fact also that no full-grown individuals were discovered in the soil, it appears that they do not exist at the present season (December to January).

Owing to the absence of full-grown animals, it is impossible to determine the species, though probably it is one hitherto unknown. There can, however, be no doubt that the young worms found in the soil will finally return to the roots to accomplish their development, thus gradually infecting the whole soil, as previously explained. Owing to the numbers in which they exist, it appears that this unknown species plays a far more important *rôle* in bringing about the disease in the present case than the species first described. It is also likely that to their presence may be attributed the dying off of the small lateral offshoots of the roots mentioned previously, though the evidence at present available does not permit of a definite opinion.

It is not improbable that even a third species of nematode is involved in the present Banana disease, for in some instances there were found in the adhering earth, and amongst the larvæ of the two forms previously described, young worms, which could not possibly belong to either owing to their shape, but which possessed the fine, sharp protrusive dart in the mouth-cavity. The number present, however, was very limited. Such is the result of microscopic examination, from which it seemed to be sufficiently clear that the nematodes are the cause of the disease, and that the second and unknown species described is by far the most injurious.

The most important question to be considered is how to cope with the disease; in other words, how to prevent the propagation of the worms. This can only be arrived at through an exact knowledge of the life-history of the pests.

In order to arrive at this an examination at one season of the year will not suffice, and with the advent of warmer weather further observations

may be made. It has been seen that all the different species pass a certain period of their life-history outside the plants themselves, that is to say, in the soil, this being a common feature in the history of all parasitic animals, since it is the only means by which they can spread. The time, therefore, in which to institute an attack is when the majority are found in the soil; any attempt to reach the pest when within the plant must be doomed to failure, for it is then in perfect security. In countries where there are well-defined seasons with great differences between them, it is more easy to ascertain exactly the different stages than is the case with such a climate as that at Alexandria, where probably development goes on steadily; that is to say, the free worms are always present in the soil. It is, on the other hand, also very likely that their numbers become considerably increased at certain periods in connection with the subsequent generations. Any remedy to be applied would therefore have its maximum effect only if applied during these periods. This matter can, however, only be definitely decided when the life-histories of the species have been followed throughout. Experiments could then be conducted as to the most suitable means to employ. In coping with nematodes attacking the beet crop in Germany, a method was successfully adopted which may be mentioned here. Nematodes are found in, one might say, almost every plant in small numbers. Practically all nematodes living as parasites on plants are not exclusively parasitic on one individual species, for if they find the necessary favourable conditions for existence they will attack another host. Just as a human being or an animal can carry a tapeworm or other parasite without apparent injury to health, and only show signs of suffering when the number increases, so within certain limits can plants withstand nematodes, and only show signs of disease when their numbers become excessive.

To combat the pest in the sugar-beet plantations, other plants which were suitable as hosts were used to attract the pest. The seed was sown early in spring, some weeks before the beets were planted. The larvæ of the nematode hibernated freely in the soil and attacked the newly sown plants, which were subsequently removed and destroyed. There were thus removed from the soil vast numbers of the pest which would otherwise have attacked the beet. This did not result naturally in a complete clearance of the pest, but the beet was enabled to resist the number which remained. The adoption of this method in the case of Bananas would require certain modifications, but something might be done in this direction; and then, by providing the plants with suitable conditions for recovery, such as good cultivation and an application of suitable manure, they may recover.

The idea has been expressed that the disease is one of recent introduction, but this does not seem probable. Species of the genus *Heterodera* were found by Dr. Looss in a garden at Alexandria some years since, and these were similar to the *Heterodera* of the Bananas. It is probable that they have now found a most suitable host in Bananas, and have consequently rapidly increased in numbers. They have probably been living in Banana plantations for some considerable time, and the result of years of increase has only now become very apparent.

Experiments in the direction indicated should be attempted, first, to

ascertain plants most suitable, the time at which they should be sown, and the time at which they should be removed. The latter information could, of course, be derived by a study of the complete life-history of the pests.

Various remedies have been suggested in the direction of applying to the soil some substance which would prove harmful to the pests. We think the most suitable substance to try at first is ordinary lime. This substance is most commonly applied as a remedy for insect pests either alone or mixed with common soot. Lime from gasworks might also be employed.

A certain quantity well incorporated with the soil around the plants might have a most beneficial effect, and would probably benefit the crop at the same time. It is, at any rate, a practical and inexpensive method. Much has also been said concerning an application of nitrates, and many misleading and inaccurate figures published regarding the percentage of nitrates present in the soil. We do not deny that an application of nitrogenous manure may have beneficial effect, not as a direct remedy against the pests, but merely as encouraging and stimulating the plant and helping it, provided the numbers of nematodes are not too excessive, to outgrow and overcome their attack.

Experiments might also show if the worms in question or similar ones are capable of attacking other and more important crops in the country. Wheat and Onions are known to suffer occasionally from the attacks of nematode worms belonging to the genus *Tylenchus*, the *Tylenchus* of the Onion causing great damage in Europe, and being found occasionally in the crop of Upper Egypt.

COMMONPLACE NOTES.

By the SECRETARY and SUPERINTENDENT.

FERTILITY OF APPLE AND PEAR BLOSSOM.

A FELLOW asks us for a list of Apples and Pears whose blossom is self-fertile, and also of those which are by themselves infertile and require to be crossed by wind or bees with the pollen of other varieties. We are not aware of any accurate observations of this kind made in Great Britain, and observations made in America, though perfectly reliable for America, do not at all necessarily hold good for this country, as the exceeding difference of soil and climate exercises so manifest an influence on blossom and on fruit.

It has, however, been observed by Mr. Edward A. Bunyard and others that "with Apples planted in large square blocks fertility gets weaker and weaker towards the centre, where frequently no fruit at all is produced." This was observed particularly in three cases, viz : in a 6-acre block of Dumelow's seedling (Wellington), in an 8-acre block of Ecklinville, and in a very large block of Cox's Orange. It was further observed that his diminished fertility towards the centre of a block did not occur when the trees were planted in alternate rows of different varieties. Some varieties, however, are so notably shy in bearing that they often bear no crop for years together even in a nursery where they are surrounded by a multitude of different varieties, some of which one would think would be sure to suit them as cross-fertilisers. As to the effect of cross-pollination Mr. E. A. Bunyard mentions that having last year crossed a 'Sandringham' blossom with 'Bismarck' pollen, the resulting fruit "was ripe and fell off three weeks or a month before any others on the tree, and was in shape and colour quite out of character, more resembling a fine 'Cox' than a 'Sandringham.' He also tells us that 'Cox's Orange' crossed with other pollen produces very much larger fruit than if fertilised with its own. Amongst Pears, 'Williams' Bon Chrétien' is generally considered to be better for cross-fertilising. Many fruit-growers will no doubt have noticed that both in Apples and Pears the amount of pollen produced generally decreases as the quality of the variety increases.

HORTICULTURAL CLUB.

Probably the vast majority of Fellows of the Society are unaware of the existence of the HORTICULTURAL CLUB, and yet it is a very pleasant little club, and does a vast amount of good work for horticulture. Sir John Llewelyn, Bart., is the kind and genial president; Harry J. Veitch, Esq., is the treasurer; and E. T. Cook, Esq., has quite recently been elected secretary, in the place of that veteran octogenarian gardener, the Rev. H. H. D'ombrain, who has acted as secretary since 1865, and is now obliged to retire on account of increasing infirmities, but who carries with him the love and good wishes of every member of the club, indeed of all who have ever met him. The subscription to the club is only £1. 1s.

a year, and the pleasant house dinners which are held once a month on one of the R.H.S. Tuesdays form delightful little reunions of a small band of ardent garden lovers, whose one wish is that others would come in and enjoy these evenings as much as they themselves do. At most of the house dinners a short paper is read on some horticultural subject, and a general discussion ensues, as gentlemen sit over their nuts and port, or coffee and cigars, as best they like. All is very informal, very homely, but, as Sir John said recently, "I have spent some of my pleasantest evenings in London at this club." So we think many others would find it, if they would but join. "But how can we join?" Well, write to E. T. Cook, Esq., care of R.H.S., 117 Victoria Street, Westminster, S.W., and you will learn how. The club too serves as a most useful adjunct to the R.H.S. For the Society has no convenient means at its disposal for offering the compliment of hospitality to any foreigner of horticultural tendencies who visits our not too hospitable shores, and this defect the club supplies, for if any foreigner of any distinction in the gardening world visits the R.H.S. at any time, the club is always ready and willing to offer hospitality and give a hearty welome. At present the club barely numbers 100 members, all told; we should indeed be pleased if 100 more who read this very commonplace note would at once enrol themselves.

On Asparagus Growing.

The old method of making Asparagus beds was really a most expensive operation, as the soil had to be excavated to a considerable depth, and replaced with fresh loam mixed with copious supplies of farmyard manure and other ingredients. Fortunately less expensive methods are now adopted, and with equally good or even better results, as the Asparagus does not require an elaborately prepared root run, but simply good drainage and a fairly porous soil. Stagnant water about the roots is absolutely fatal, and consequently drainage, either natural or artificial, is of the very utmost importance. After having, therefore, first made sure that any surplus water can pass away freely, the soil should be dug 18 inches deep; and if light, a dressing of marl or even of good clay, together with cow manure, will assist in making the soil more dense and retentive. If, on the other hand, the soil should be heavy, strawy manure, road scrapings, burnt garden refuse, or even sifted coal ashes, are all useful in making the soil more porous and warmer. On most soils the operation of preparing the site for the new beds is best done in the autumn, leaving the surface as rough as possible for the weather to act upon it. Early in April beds may be made, 5 feet wide, with an 18-inch alley between. This size of bed will allow of a centre row of plants, with a row on each side of it, 18 inches from the centre row, and 1 foot from the margin of the bed, the plants being 2 feet apart in the rows. Two very important points are (1) not to plant until the plants have commenced to grow, and (2) not to allow the roots to become dry between the time they are received from the nursery and the actual planting. In planting, the roots ought to be spread out evenly in all directions, and immediately covered in with soil; and should the ground be at all dry, a thorough soaking of water is advisable as soon as ever the bed is finished.

Another plan is to sow the seeds in rows at the distances already mentioned, and, when the seedlings have sufficiently advanced, thin them out to 2 feet apart in the rows. For the first year a light mulch of strawy manure is sufficient, which is best cleared away when the tops die down, leaving the beds with no mulch on during the winter. In the following spring, about the middle of March, a mulch of well-rotted farmyard manure is of great assistance, as it supplies plant food and keeps the soil moist and cool during the hot summer months. This is best removed again in the autumn, as the Asparagus is perfectly hardy, and the covering of the beds for the winter with a more or less heavy mulch of manure not only keeps the beds wet and cold, but there is a great loss of plant food caused by the rain and melting snow carrying the salts contained in the manure down below the reach of the roots or into the drains. While in active growth the Asparagus enjoys a liberal diet, and, in addition to occasional soakings of diluted liquid manure, a dressing of agricultural salt at the rate of 3 oz. to the square yard, or 3 oz. of kainit on soil of a light character, is very beneficial, applied about once every three weeks. On heavy soils, 2 oz. basic slag, or 2 oz. fine bone meal, is excellent, also applied every three weeks during June and July.

Owing to Asparagus being such a favourite, or to the scarcity of other vegetables, it very frequently happens that cutting of the young growths is continued much too long and too late in the season. This is a great mistake, and injures the beds very seriously. In the great majority of cases the last week in June is quite late enough to continue cutting, and by ceasing then the plants have time to make good growths, followed by strong crowns which will produce excellent results the following year.

THE BEECH-TREE PEST.

Since our last issue of the JOURNAL we have received many specimens of *Cryptococcus fagi*, with inquiry as to whether it is the pest alluded to on p. 598, and in every instance this has proved to be the case. The pest seems to be even more widely spread than we had imagined. One Fellow, in a very interesting letter reporting the recent appearance of it in Yorkshire, says: "I have noticed in every case here that the insects first attack the roots just above the ground and spread upwards. I shall therefore have this part of the trees well washed with soft soap, in the hope of stopping the spread of the disease." We should be glad to know whether anyone else has noticed this fact of the insects beginning at the base and spreading upwards, as every atom of information we can get as to their habits and life-history may help us the better to fight against them.

The same correspondent says: "We have some magnificent Copper Beeches, but they so far are not affected." There is an idea that the pest does not attack the Copper Beech, and the only instance we have heard of to the contrary is that quoted at the Scientific Committee by Professor Henslow. Can anyone tell us of any other case of a Copper Beech being affected?

Another correspondent suggests that the pest only attacks trees which are already exhausted from the drought of the past ten years. But, alas! we know of it on many a young and vigorous tree.

Objectionable Weeds, &c., on Golf and other Greens.

The vast majority of players of golf, tennis, bowls, &c., have a very decided objection to Clover, Plantains, Daisies, and Dandelions on their greens or courts, as all such weeds interfere more or less with the accuracy of the play; and what the player likes to see is a green with a close sward of fine grasses only. On some soils, particularly those of a rather heavy nature, Clover is very persistent, and certain manures encourage the plant, such as superphosphate, and manures containing a large percentage of potash; and if applications of them are repeated annually (as is often the case), there is a danger of the Clover forming the major part of the sward. Such manures should therefore be avoided, and those only used which will assist fine grasses and discourage all objectionable plants. A mixture that has been used with splendid results on some well-known golf links in the neighbourhood of London is made of equal proportions of nitrate of soda and sulphate of ammonia, and applied at the rate of one pound to the rod (5½ square yards). This is given several times during the summer months, and if the weather is dry it is thoroughly watered in. More than a pound to the rod is never applied at a time, as it is found that it is far better to use only that quantity, and repeat it, than to apply a stronger dressing. Before the application of the nitrate of soda and sulphate of ammonia the greens were literally covered with Clover, but since employing it, not only Clover, but all the plants with objectionable broad foliage have disappeared, the reason being that the manure falls on the flat leaves and kills them; and by frequently repeating the application any new growths are, from time to time, destroyed, and this continual weakening of the plants eventually destroys them altogether.

A Difference of Opinion.

That opinions differ is of universal experience, finding expression in the old Latin proverb "Quot homines tot sententiæ," but you seldom find such a contrast as that contained in the two following extracts from letters from two Fellows recently received:—

"There is no other Society in the world which gives you so much for one guinea."

"It seems to me I do not get much for my guinea."

Let us reckon up, as far as possible in money value, what a Fellow of our Society gets for his subscription in 1902.

	£	s.	d.	
1. 22 Drill Hall Meetings at 1/-	1	2	0	A £2. 2s. Fellow gets 3 times, and a £4. 4s. Fellow 6 times, these items.
2. Temple Show, 1st day 7/6, 2nd 2/6, 3rd 1/-	0	11	0	
3. Rose Show, 1st day 7/6, 2nd 2/6 . .	0	10	0	
4. Fruit Show, three days at 1/- . . .	0	3	0	
5. Three issues of the Journal at 7/6 . .	1	2	6	
	£3	8	6	

Besides this there are certain things which cannot easily be assessed at an exact money value, for instance:—

6. The use of the best Horticultural Library in England.
7. A share in the surplus plants.
8. Facilities of chemical analysis at reduced cost.

9. Inspection of gardens.

10. Unlimited privilege to suck the brains of the Scientific Committee and of the Secretary and Superintendent.

But supposing these last five items to average a value of little more than 6*s.* each, you arrive at a grand total of £5 for £1. 1*s.*, to say nothing of the satisfaction of joining with others to help on the progress of the most beautiful and the most peaceful of all the arts and sciences.

The Liverwort under Glass.

Everyone is familiar with the Liverwort, not only in greenhouses and frames, but also spreading its slippery surface on shady walks in the garden and in sheltered nooks in the rockery. It is under glass, however that the Liverwort (*Marchantia polymorpha*) is such an intolerable nuisance, as well as an eyesore, covering up the surface of the soil in pots with its thick flat growth, and frequently coating the soil of seed-pans with such a dense layer of growth that many kinds of seeds are utterly unable to penetrate it, and are choked as they germinate. In many cases the Liverwort is produced by the spores being in the water used for watering and syringing, or the spores may settle on the surface of the pots, being carried in the wind from fruiting plants of Liverwort growing on the ashes or gravel on which the pot-plants or seed-pans are stood. One is often asked, " What is the best method of combating this unsightly and noxious plant and keeping it at a respectable distance ? " Well, in the first place try perfect cleanliness in all glasshouses, frames, and such like ; not only keeping the pots themselves clean, but also the ashbeds or whatever else it be the pots are stood upon. And should any of the Liverwort appear, brought in the water or wafted on the air, a very slight application of powdered sulphate of ammonia will kill it, and will also stimulate growth in the plants. Sulphate of ammonia will destroy every atom of Liverwort on which it falls ; but, as it is a very powerful manure, only a small quantity must be used or the plants may be injured. Half a teaspoonful is ample for a pot 10 inches in diameter, and care should be taken that none of the powder fall on any green foliage except the Liverwort, or it will burn and scorch it. Another plan is to remove the Liverwort with a pointed stick, but this is apt to lay bare the surface roots or to pull up the recently sown seeds, and necessitates top-dressing again with fresh soil, as well as taking up a considerable amount of time ; whereas the former method is very expeditious, and, if done carefully and with moderation, stimulating to the plants as well. To prevent the loss of very fine seeds, Fern spores and such-like, the soil in which they are to be sown should be thoroughly sterilised, i.e. *baked*, to destroy all germs in the soil ; and afterwards, when watering is needed, it should not be given from above, but the pot or pan should be plunged nearly up to the rim in water, thus allowing the moisture to soak up from below. In this way the surface is kept clear of Liverwort, and the seeds can germinate at will.

Mistletoe.

Apropos of the note on page 592, another Fellow sends the following information :—" On February 12, 1901, I smeared two berries on the

underside of a branch of an Apple-tree in my garden, and by December, so far from the seeds having remained dormant, the site of the sowing was represented by two conspicuous pimple-like excrescences seated side by side in a slight cavity formed by the rupture and forcing up of the bark around them, evidently by inserted roots. These excrescences are of a greenish colour, rather more than hemispherical, and would each measure fully a quarter inch in diameter. They presented much the same appearance in the early autumn, when I first noted that establishment had taken place. It is obvious, therefore, that during the first season the seeds are capable of penetrating the bark, which was perfectly smooth and intact when the berries were rubbed in, and doing a considerable amount of rooting work as a preliminary to leaf formation. What the next step will be remains to be seen, but this experience, at any rate, conflicts with that of your correspondent as regards dormancy until the succeeding spring, since the rooting process must have been going on for some time to judge by the swelled and ruptured bark, in a cavity of which the two hemispherical bodies are seated."

Our correspondent's observation shows two things :—

1st. That Nature works in differing ways, and not always by a single rule or in one undeviating manner; and

2nd. That it is never safe to generalise from one or two isolated examples.

Hardy or Tender.

Many and many a plant that is coddled up in greenhouses would, in suitable soil and position, be far better out of doors; and probably more hardy plants have been destroyed by such cosseting than by all the exceptionally hard frosts of the last century. At the same time, a plant whose natural habitat is in a sheltered nook and in porous sand or rubble must not be expected to survive a winter spent in heavy clay and fully exposed to those most trying changes of our early spring, when a day of biting north-easterly wind is succeeded by a night of damp fog from the south-west, only to be followed up by another easterly change with sunrise. Multitudes of so-called tender plants can stand the actual amount of frost we get, but they succumb to the constant and rapid changes, when our climate never seems to know its own mind two days together, and, except that it is determined always to be in extremes, pays little, if any, heed to which extreme it is. Some little knowledge and experience, too, are needed to know what sort of spot and what sort of soil are likely to suit a plant. But if these things are known many plants accounted tender will do quite well, if not better, out of doors. A Fellow, writing from Dawlish, says :—"I grow *Primula megasecæfolia* in the open. It flowered splendidly from the end of November to the beginning of January without any other protection than the dressing which I give to all rockery plants, viz., an inch of sifted leaf-mould. It was indeed quaint to see its flower-sprays standing up well above a coat of snow. Yet this has happened twice. Last night we registered 12 degrees of frost, and the *P. megasecæfolia* foliage was solid with it, but in the morning it was quite uninjured. It is planted facing due north. Gardeners are too fearful. *Daphne indica*, Abelias (in five varieties), *Azalea indica*, Banksias, 'Bottle-brushes,' Melias (both Indian and Japanese), Pomegranates, Camellias, *Lonicera*

Hildebrandiana, Buddleias (*Colvilei*, *Lindleyana*, and *madagascariensis*), Acacias (in variety, including *dolabrata*), Abutilons, Agapanthus, Dianellas, &c., are bearing the same cold, viz., 12 degrees of frost, without injury. They have *no* protection. The Mimosa is almost in full bloom. Agapanthus holds its foliage well, though it is the *gigantea* variety. A chance seedling of *Primula sinensis* is looking perfectly happy outside, though white with frost. The Spider Lily of Japan seems to enjoy cold, whilst a big plant of Kniphofia (*K. a. grandiflora*) has not been out of bloom since October. At Christmas it had fifteen flower-spikes, now it has four. *It* certainly does not mind frost, neither does *Persica Davidiana*, both white and pink, both of which are in full flower. *Rosa Banksiæ* was not to be beaten. I have gathered several sprays of half-open flowers, and every 'node' has a knot of buds. I fancy soil has much more to do with plant life than temperature."

Of course Dawlish is to some extent a warm and favoured spot, but the mere fact of these plants flourishing amid 12 degrees of frost shows them not to be quite so tender as we are wont to think them.

Neglected Varieties of Grapes.

The vulgar love of size and of appearance, quite irrespective of quality and flavour, has caused many of the most delicious varieties of Grapes to go practically out of cultivation, and they are only very occasionally to be met with in the gardens of those connoisseurs who still consider the flavour of a fruit to be of more importance than its size and its appearance. There is, for instance, no comparison whatever between the quality and flavour of the rusty-looking 'Grizzly Frontignan' and the insipid 'Gros Colmar' or 'Gros Maroc.' And yet how very, very rarely is the former found even in gardens where the Grapes are not grown for sale, but are used entirely for home consumption! All the small-berried varieties, in fact, are suffering from most unmerited neglect. We are not, however, without hope that the tide is turning, and that the days are coming when the exquisitely delicious small-berried Grapes will again find favour and once more be grown extensively. They require no special treatment, as the same soil and the same cultural skill bestowed on, say, 'Black Hamburgh,' will prove equally suitable for all the varieties that we name below.

'Grizzly Frontignan.'—We put this at the head of the list as being one of the very finest flavoured and best of all the Frontignan class of Grapes. The bunch is similar to 'Lady Downes' in form, but the berries are distinctly smaller, and, as the name implies, are of a grizzly or dull red colour. When the berries just begin to shrivel, the flavour is remarkably rich and sweet. It is a very good variety for a mid-season vinery, the bunches hanging well till Christmas. It is also known as 'Red Frontignan.'

'Angers Frontignan.'—A very pretty deep black variety, with small bunches and small berries, but of excellent flavour. Where early forcing is desired this variety is very reliable, as it always sets its fruit well either when planted out or when grown in pots.

'White Frontignan.'—Another free setting and delicious Grape, succeeding equally well in the early or mid-season vinery, and, like both of the above, a good and constant bearer. The bunches and berries are of the usual Frontignan size.

'Auvergne Frontignan' and 'Ascot Frontignan' are both white varieties, of first-class quality and flavour, and are equally at home in the early or mid-season vinery. They are both free bearers, and are specially suitable for pot culture.

'Ferdinand de Lesseps.'—This is a lovely small-berried variety, of exquisite flavour. The bunches are distinctly small, and so too are the berries, which are oval in shape, of a deep golden colour, and very inviting looking. It was raised by Messrs. Pearson, of Chilwell, and received a First-class Certificate from the Royal Horticultural Society in 1870.

'Ascot Citronelle.'—A variety with small, white, oval berries arranged in rather small bunches, and with a very pleasant but decided Muscat flavour. It is a very early variety, ripening at least a fortnight before 'Black Hamburgh' when grown in the same house. It is very valuable for early forcing where a small-berried but fine-flavoured Grape can be appreciated. A First-class Certificate was awarded it in 1871.

'Mrs. Pearson.'—A better known Grape than most of the above, because it has bigger berries; but it is still not so universally grown as it deserves. For although the round white berries are not so big as some, the bunches are fine and large and of good shape, and will hang in good condition longer than any other white Grape. It is altogether a first-rate late Grape, and received a First-class Certificate in 1874; and if it requires a little more care in growing than some poorer Grapes, it is all the more credit to the grower when it is well done.

'Royal Muscadine.'—This old variety used to be much more grown than it is now, and, though it is a good outdoor Grape, it is far better grown under glass; the long bunches of round pale amber-coloured berries are then of delicious flavour, and they possess the merit of hanging well for a long time after they are ripe. For a cool greenhouse there is no better variety.

Just a word of warning:—Do not overfeed these refined small-berried varieties of Grapes, as they will not stand stimulants like the larger, coarser, and more robust ones.

Effect of Grafting.

A Fellow inquires:—"If I graft 'Black Hamburgh' on 'Gros Colmar' I suppose it will make the Grapes later and the individual berries larger than on ungrafted 'Black Hamburgh'; but would they also take after 'Gros Colmar' in length of time in colouring and liability to split?" It is impossible to say dogmatically that the Colmar stock would have absolutely no effect on the 'Black Hamburgh,' but it certainly would have very little. How much we cannot say; careful records taken from two plants, one grafted and one not, growing side by side in the same house, are required in order to institute an exact comparison. But speaking from common experience, we are sure that 'Black Hamburgh' may be grafted on 'Gros Colmar' with every confidence of success; the fruit would not be more than a few days, if at all, later than from 'Black Hamburgh' on its own roots; the berries would not be larger or at all more liable to split, nor longer in colouring, nor the foliage more liable to red spider.

Any accurate observations on the effects of grafting any plants would be very acceptable. For example, a Fellow tells us that in India "the Gardenia is grafted on the stock of a common white Camellia," and that the result is "white flowers like small single Camellias, but very sweet-scented." This we quite expect is an inaccurate observation, and probably the flowers are those of the wild single Gardenia, and have nothing whatever to do with the Camellia. But even in this we would not be dogmatic. Let someone try whether Gardenia will graft on Camellia, and *vice versa*, and if it will, observe the flowers. There is nothing like actual experiment.

Pony's Lawn Shoes.

"What are the best kind of shoes to prevent a big pony from marking the lawn when mowing?" There are various sorts of "Horse Boots" sold, and most of them are fairly efficient, though some are very clumsy in appearance. We have seen a new one, which looks very neat; it is called "The Pattisson Lawn Boot." The actual sole is made of leather and india-rubber, and on this is fastened a strong steel plate with a toe-cap in front, and a clip and screw behind, which attaches it to the horse's shoe. It has no upper leathers or straps of any sort, and thus leaves the hoof in a perfectly natural condition. *The Field* speaks very highly of it, and recommends it for lawns, golf links, and cricket grounds, but we have had no actual experience of it ourselves.

Compensative Manuring.

There is an idea abroad, and no doubt it contains a modicum of truth, that the best possible manure for any crop consists of chemical constituents exactly equivalent to the chemical constituents of the crop; in other words, that the land requires to be compensated by an application of exactly those constituents which are found in the ripened crop, and which it is assumed the crop must have extracted from the soil.

We are reminded forcibly of this by the following passage in a letter from a Fellow: "There was a very enthusiastic gardener in the Highlands who always manured his fruit trees with decayed fruit. I should have thought the mould and decay of the fruit would rather have been injurious." So we should also think.

But the argument overlooks three points. First, that of some of the constituents required for healthy growth there is a practically inexhaustible quantity in the soil, so that there is no need to put that back whatever it may be. Secondly, the air and light are always acting on the soil all through the year, and are themselves producing chemical changes which to some extent at least replace any loss from root action. And thirdly, this argument overlooks the fact that all plants take in a large amount of their solid constituents through the medium of their leaves, which have the power of extracting it from the air, and therefore the soil has no need to be compensated with this material.

Certain chemical substances are known to be favourable to the production of certain crops. It is far better to use them than to adopt the theoretical idea of compensating the soil by returning to it the exact equivalent of the constituents found in the last crop.

BOOKS RECEIVED.

"Coccidæ of the British Isles." By Robert Newstead, A.L.S. (The Ray Society, London.)

Mr. Newstead has produced a book which will be a standard of reference and information on the Scale insects of this country and their near allies for many years to come. All the known species are described—the great majority illustrated in thirty-four beautifully coloured plates. There are chapters on their life-history, migration, prevention, and their natural enemies. The pages relating to insecticides and their application are most thoroughly and carefully prepared, and fullest details given. Amongst the most interesting chapters from a general point of view is that on birds as included amongst the enemies of the *Coccidæ*. It has been doubted more than once whether birds were at all destructive of scale, but Mr. Newstead, by careful examination of the contents of the stomachs of various birds, has proved beyond doubt that some of them at least feed very extensively on Coccids. It is a book which should be in every gardener's library as well as amongst the books kept in the bothy, for the sooner English gardeners study insect pests in the same methodical way in which they do in America the better for our profession.

"The Culture of Greenhouse Orchids." By Frederick Boyle. 8vo. (Chapman & Hall, London.) 8*s.*

A book which may prove very useful to real amateurs. The greater part of the book (pages 67 to the end, p. 224) is concerned with cultural notes and details of each genus and species, which are distinctly valuable. The introductory chapters on Orchid-houses and on Potting are also full of suggestive matter for genuine amateurs who wish to be practically their own growers, and the chapter on Prices is at least amusing.

"The Gardener's Assistant." By Robert Thompson. New edition, by W. Watson, F.R.H.S. (Gresham Publishing Company, London.) In 6 vols., 8*s.* each.

Vol. V. is concerned with Cherries, Figs, and Small Fruits. A chapter on the Orchard-house is excellent, but errs on the side of shortness. This is followed by chapters on Vines, Pines, Melons, Cucumbers, Tomatos. And the volume ends with very interesting accounts of fruit preserving (of all sorts and kinds), packing, and storing. The figures fully maintain their general excellence.

"Book of the Apple." By H. H. Thomas. (John Lane, London.) 2*s.* 6*d.* Crown 8vo.

This little book appears to contain all that one can possibly want to know about the cultivation of Apples. It treats of the best forms of tree,

of planting, pruning, gathering, storing; it treats of insect pests and how to deal with them, and gives lists of choice varieties selected for various different purposes. There is also a very valuable chapter at the end on Cider, and a few (very few) recipes for cooking Apples; but we find no mention of bottling Apples, than which we know no better way of prolonging the season of any variety which is quickly past its best. If kept artificially Apples soon lose their briskness, but bottling preserves it, and you may in this way have Keswicks, Ecklinvilles, or Grenadiers as crisp and brisk in May as they once were in September and October. They require less cooking, but they cook quite as well.

"Trees and Shrubs." By A. B. Buckley. (Cassells, London.) 6*d.*

A brightly written booklet of 80 pages, nicely illustrated, intended to quicken the observation of children for common country trees and shrubs. The information it contains would, however, suit a great many grown-up children who in their childhood never had the advantage of such simple and straightforward nature teaching.

"Manual of Botany." By Dr. J. Reynolds Green, F.R.S. (J. & A. Churchill, London.) 2 vols. 17*s.* 6*d.*

We have here a thorough student's book, but exceedingly clearly written, and illustrated with 1,214 most helpful illustrations. The first volume is concerned with the morphology and anatomy of plants, while the second deals with their classification and physiology. We do not know that the student of such subjects could wish for a better guide.

"Plant Relations" and "Plant Structures." By Dr. John M. Coulter. (Hirschfeld, London.) 6*s.* each.

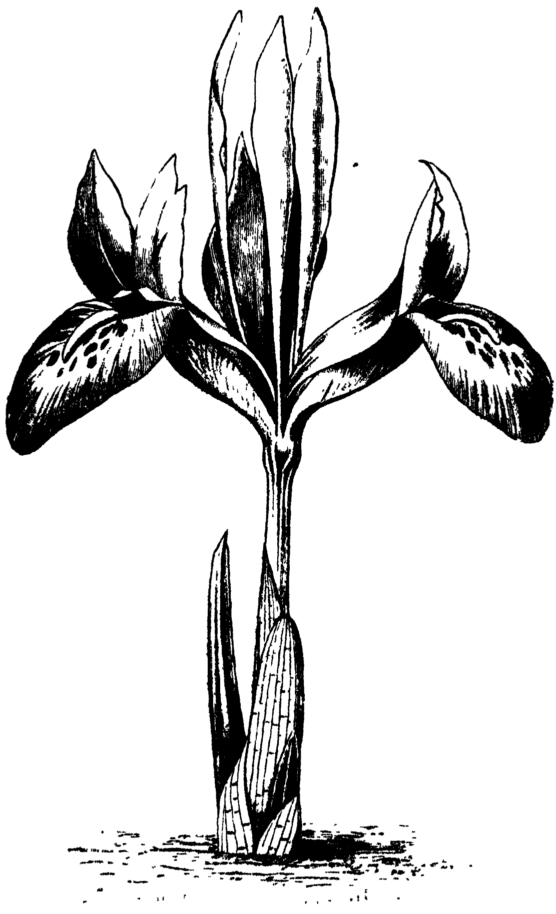
Dr. Coulter is Professor of Botany at the University of Chicago, and his books are written mainly with a view to being of use to teachers in higher secondary schools, and to supplement laboratory and field work. "Plant Relations" deals chiefly with ecology and physiology, and "Plant Structures" with morphology and an attempt to trace the evolution of the plant kingdom step by step from the rudimentary Algæ to the highly organised Angiosperms. Both volumes are beautifully illustrated, and "Plant Structures" especially strikes us as being full of interest to any reader of ordinary intelligence.

"The Best Hardy Perennials." By F. W. Meyer. (Blake & Mackenzie, Liverpool.) 15*s.*

This work consists almost exclusively of forty-eight large coloured plates, for the most part done exceedingly well – in fact we only find fault with the colouring of *Senecio pulcher.* Facing each plate is a short letterpress description, which, if it errs at all, errs on the side of brevity. We could well have borne with longer cultural details from an author of such well-known skill in cultivation as Mr. Meyer.

"The Book of Bulbs." By S. Arnott. (John Lane, London.) 2*s*. 6*d*.

A book that meets a very general want amongst amateurs. Two-thirds of it are concerned with hardy bulbs and all the manifold ways in which they may be used and treated for embellishing our gardens. The other third is divided almost equally between half-hardy bulbs and bulbs for stove and greenhouse. Alas for an index! We notice, however, that Mr. Arnott treats the term "bulb" in its broadest possible sense, and makes it include not only Dahlias but even Arums and Lilies-of-the-Valley. We do not find fault with the "open door"; indeed, the fact of such catholicity should make the book all the more useful to the amateurs to whom it will appeal.



REPORT ON APPLIANCES, INSECTICIDES, AND MANURES.

Diffuser Syringe (Sinclair).

This is a small vessel or reservoir fitted with a little syringe at the top, which ejects a fine spray, and is very useful for spraying plants, flowers, &c., as it is light, portable, and may be worked with ease by a lady.

Triplex Syringe (Sinclair).

A very useful syringe; by simply a turn of the wrist, a jet of coarse or fine spray is produced without the trouble of putting on nozzles.

Fumigating Compound (Bush).

A liquid that is vaporised by means of a spirit lamp placed underneath a small vessel containing the insecticide. It proved deadly to all insect life—except mealy bug—and was not injurious to foliage.

Fumer (McDougall).

These are composed of a solid compound in a small tin, with a wick underneath. The cap of the tin is removed, the wick ignited, and the tin placed on the floor of the house, which is quickly filled with a vapour that is very deadly to Thrip, Aphis, White Fly, and Red Spider, and perfectly harmless to tender foliage.

Insecticide Sheets (McDougall).

An excellent fumigator, but in our opinion is superseded by the various vaporisers now on the market, the latter being safer, cleaner, and more effective.

Manures.

1. Rose Manure (Darling).—A very good manure for Roses, giving substance to both flowers and foliage, combined with a sturdy growth.
2. The Chelsea Horticultural Manure (J. Veitch).—This manure again proved its excellence both under glass and outside, especially for plants in pots, and fruit of all kinds.

Paints.

1. Aspinall's Greenhouse Enamel (Burlingham).
2. Velure (Chancellor).

Both of the above paints have a glazed surface, and are not supposed to crack with sun or wet. After being applied six months both are free from any defect, beyond being discoloured by the fogs. Paint made from white-lead applied for comparison is equally free from defect.

REPORT ON MISCELLANEOUS VEGETABLES AT CHISWICK, 1901.

ARTICHOKE.

Artichoke de Laon (Vilmorin).—A variety of the 'Globe' type that has not yet had time to prove its merits at Chiswick.

AUBERGINE.

Mixed varieties (Bonavia).—All the varieties produced very large fruits of different forms and colours. If the seeds are sown early in April, the seedlings grown on sturdily in a greenhouse or frame, and the plants afterwards put out in a warm sheltered border early in June, the plants will crop freely; or they may be grown all the summer months in pots in cold frames.

BEANS, RUNNERS.

A small collection was sent by Messrs. Carter, Sutton, and Goody, but they were not a success, and will be tried again.

BORECOLE.

Veitch's Exhibition (J. Veitch).—All the plants destroyed by fog in October and November.

BROCCOLI.

White Sprouting Dwarf (Harris).—A variety with very handsome variegated foliage, but the fogs killed the plants before they could form heads.

CARROT.

Long Blood Red (Carter).—Roots long, handsome, deep rich colour, the core being the same colour as the outer part, foliage very fine. A handsome distinct variety.

GOURD.

Italian Scarlet Flesh (Bonavia).—Gourds of medium size, dark green skin, and red flesh. The plant is a rampant grower and free bearer. When quite small the fruits are very similar to Vegetable Marrows if cooked.

INDIAN CORN OR MAIZE.

1. Country Gentleman (J. Veitch).—Height, 4 feet; cobs or seed-pods long and thick; foliage long, broad, and green.

2. Early Metropolitan (J. Veitch).—Height, $3\frac{1}{2}$ feet; cobs rather short, very thick, and early in maturing; foliage long, moderately broad, and green.

3. The Henderson (J. Veitch).—Very similar to No. 1. Maize makes an excellent vegetable if the cobs are cooked when the seeds have attained full size, but have not commenced to harden; if allowed to become hard, the seeds are mealy and of an indifferent flavour. The

seeds may be sown in gentle heat about the middle of April, and grown on in a cool place. Early in June the plants should be put out in a sunny position, on good soil, at a distance of two feet apart each way. Another plan is to sow the seeds at the end of May where the plants are intended to crop, taking care that the plants have ample room for development.

MELON.

Chitla (Bonavia).—It is doubtful if the true variety was sent to Chiswick, as the Chitla Melon of Lucknow should have white flesh of delicious flavour. The variety received had scarlet flesh, which was hard and almost flavourless.

ONIONS.

1. Ailsa Craig (Dean).—A very fine stock of this well-known variety.

2. Hall's Clayton (Hall).—Bulbs deep round, good shape; skin pale brown; heavy; short top; stock very true.

3. The Wildsmith (R. Veitch).—Bulbs round, good shape; skin deep brown; large, heavy, short top, fine stock.

4. White Spanish (Wheeler).—A very true stock of this popular old variety.

PARSLEY.

Perennial (Barr).—Plants very dwarf, with beautifully curled foliage.

Perfection Moss Curled (Barr).—Plants rather tall, with handsome well-curled foliage.

SAVOYS.

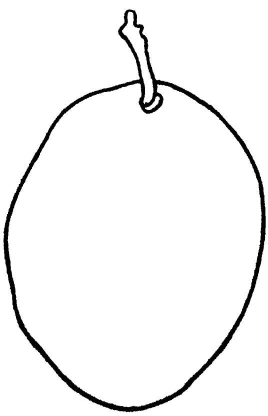
1. Drumhead (Dobbie).—Very large, with firm hearts and spreading outer leaves. One of the most useful varieties for large establishments.

2. Green Curled (Dobbie).—Medium size, with firm hearts and a moderate spread of outer foliage.

3. Perfect Gem (Dobbie).—Small to medium size, very firm hearts, with a small spread of outer leaves. The plant is remarkably dwarf and exactly the size for table.

TOMATOS.

A few varieties only of Tomatos were received for trial, and all of them will be tried in 1902 for comparison with other new and old varieties.



REPORT ON MISCELLANEOUS SALAD PLANTS GROWN AT CHISWICK, 1901.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.
× × × = Highly Commended.

Beet.

Crimson Ball (Carter).—Roots round, handsome, bright reddish crimson; medium size; foliage short, compact, deep purple.

Chervil.

Curled (Barr).—This differs only from the Common Chervil by the foliage being curled, and is exactly the same in flavour. On hot light soils this plant should be sown in a partial shade; and where continuous supplies are required, successional sowings should be made.

Chicory.

All the stocks of Chicory were sown on May 3.

1. Barbe-de-Capucin (Barr).—Foliage long and very broad, deeply serrated. The plant is very vigorous, bearing a great quantity of leaves.

2. Common (J. Veitch).—The same as No. 1.

3, 4. Large-rooted (J. Veitch; Barr).—Foliage long and broad, abundantly produced, with roots of exceptional size.

5, 6. Witloof, F.C.C. January 19, 1876 (R. Veitch; J. Veitch).—A slightly smaller form of Nos. 3 and 4.

Corn Salad, or Lamb's Lettuce.

This is a very serviceable plant for use during the winter and early spring months, and is much appreciated by some for mixed salads. The plant is quite hardy, being a native of Europe, and when sown on good soil early in August, thinned out to about six inches apart and kept free from weeds, it will produce an abundant supply of leaves from October to December. Successional supplies may be had by sowing up to the early part of October.

1. Broad-leaved Italian (J. Veitch).—Plant very dwarf, with broad oval leaves, which are pale in colour. This variety does not appear to be very hardy or vigorous.

2. Cabbaging (Barr).—Plant dwarf, vigorous, with dark green roundish erect leaves. This variety was the most vigorous and best.

3. Green Cabbaging (J. Veitch).—Same as No. 2.

4. Green Étampes (J. Veitch).—Plant dwarf, vigorous, with very dark green and rather narrow leaves. A very good variety.

5. Large-leaved (Barr).—Very similar to No. 1.

6. Large Rosette Green Cabbaging (Barr).—Same as No. 2.

7. Lettuce-leaved (J. Veitch).—A darker-leaved form of No. 1.

Cress.

1. Australian Salad (Barr).—This was three days later in germinating than the other varieties of Cress, and a week later in coming into use. It is not so useful as the Plain-leaved or Triple Curled.

2. Plain-leaved (Barr).—This is too well known to need any description.

3, 4. Triple Curled (J. Veitch; Barr).—A pretty curled form of No. 2 and equally early in coming into use.

5. Winter or American (Barr).—Failed to germinate.

Cucumber.

1. Perfection Ridge (Carter).—Not a success.

2. Ridge (R. Veitch).—Not a success.

3. Triumph (Barr).—A large white-spined variety, rather long in the neck.

4. X. L. All (Kent & Brydon).—A very long variety, but not of very good shape.

5. Wallace's Strain (Wallace).—Same as Lockie's Perfection.

Dandelion.

New Thick-leaved Cabbaging (Barr).—This well-known plant is much esteemed by some when blanched like Chicory. This variety produces a great mass of medium-sized leaves, which should make it specially useful for blanching for salad.

Mustard.

1. New Chinese (Barr).—This variety makes large foliage, and is of little or no value for salad purposes, possessing scarcely any flavour.

2. White (Barr).—This is too well known to need any comment.

Purslane.

Green Purslane (Barr).—A strong growing, erect variety, valuable for forcing in frames for early salads; it may also be used as a vegetable when grown in the open air.

Sorrel.

French Broad-leaved (Barr).—Foliage large, pale green, and freely produced. It has a very acid taste, and is not likely to find much favour for salads.

Celery.

1. Brydon's Prize Red (Kent & Brydon).—Foliage broad; hearts large, thick, deep red on the outer stalks; crisp, and of good flavour.

2. Brydon's Prize White (Kent & Brydon).—Foliage pointed and deeply serrated; hearts short, thick, white, crisp, and of fair flavour.

3. Fin de Siècle (Masters).—Foliage broad; hearts short, thick, very white, crisp, and of good flavour.

4. Schumacher (Masters).—Foliage much serrated; hearts short, thick, white, and of fair flavour.

Endive.

All the varieties were sown on July 18, and when the seedlings were large enough they were planted out on a sheltered border at a distance of 15 inches apart each way. All the stocks made very good growth, and were remarkably true.

1. Batavian White (J. Veitch).—Foliage large, pale green, spreading; hearts large; growth vigorous.

2. Extra Fine Green Curled (Barr).—Foliage long, large, and beautifully curled, spreading, with large hearts; a very vigorous variety.

3. Improved Green Curled (J. Veitch).—Same as No. 2.

4. Improved Green Batavian (Barr).—Foliage long, broad, and more upright than any of the other varieties, with large hearts; growth very vigorous.

5. Improved Round-leaved Batavian (J. Veitch).—Foliage broad, long, and flat. A very large vigorous variety, with good hearts. An improved form of the Round-leaved Batavian which received a **F.C.C.** October 11, 1878.

6. Large Green Curled (J. Veitch).—A vigorous form of No. 2.

7, 8. Moss Curled (J. Veitch; Barr).—Foliage rather short, pale green, and beautifully curled; hearts small, compact, and very pretty.

9. Paris Green Curled (J. Veitch).—Very similar to No. 2.

10. White Curled, **F.C.C.** October 11, 1878 (J. Veitch).—Foliage long pale green, finely curled; large hearts; growth vigorous.

LETTUCE.

Thirty-nine stocks of Lettuce were received for growing in the salad trial, all of which were sown in cold frames on March 15, and while the plants were very small they were transplanted on to a warm border that had been well manured. All the stocks made excellent growth, in spite of the drought, and were remarkably true. The Committee examined the collection on two occasions, viz. June 20 and July 5.

1. Balloon (Hurst), **A.M.** August 13, 1895.—Foliage dark green, large, solid, self-hearting, compact, crisp, and of good flavour. Stood the drought well without running to seed. Ready June 24. Cos.

2. Big Boston (Masters), **A.M.** June 20, 1901.—Foliage pale green, large, and moderately compact; hearts large, solid, crisp, and of excellent flavour. Stood the drought well. Ready for use June 20. Cabbage.

3. Bloomdale Reliable (Masters).—Foliage pale green, large, and rather spreading; hearts large, solid, and rather bitter in flavour. Ready June 17. Cabbage.

4, 5. Continuity (R. Veitch, Hurst), **A.M.** June 20, 1901.—Foliage pale green, heavily marked with red, very compact; hearts of medium size, very solid, and of good flavour. Ready June 17. Cabbage. There are two stocks of this variety, one being much more red or crimson than the other, but quite the same in other respects. Stood the drought remarkably well.

6. Drumhead (R. Veitch).—A very fine, well-selected and true stock of this old well-known Cabbage variety. Ready June 26.

7. Duke of Cornwall (R. Veitch), **A.M.** July 5, 1901.—Foliage large and spreading, pale green, slightly suffused with red; hearts very large, solid, crisp, and of excellent flavour. Stood the drought well. Ready June 26. Cabbage.

8. Dwarf Perfection (Barr), **A.M.** July 5, 1901.—Foliage dark green

and of medium size; hearts large, solid, compact, and of very good flavour. Stood the drought well. Ready June 19. Cos.

9. Epicure (R. Veitch).—This variety has curiously long divided Dandelion-like leaves, very large and spreading, forming no heart, and of no value. Stock not quite fixed.

10. Fulham Cos (Hurst).—Foliage bright green, of medium size; hearts large, solid, compact, and of pleasant flavour. Stood the drought well. Ready June 20.

11. Grand Rapids (Masters).—Foliage large, bright green, and beautifully curled, forming little or no heart, and not very good in flavour Ready July 5. Cabbage.

12. Green Favourite (Barr).—Foliage dark green, large, and compact; hearts of medium size, very solid, and of good flavour. Stood the drought well. Ready June 29. Cabbage

13. Green-fringed (Barr).- Foliage bright green, large, and spreading, the margins beautifully cut and curled. An exceedingly handsome variety, but of little value for salads, as it does not form any heart.

14. Harbinger Forcing (Barr), × × × July 5, 1901.—Foliage large and spreading, pale green: hearts of good size, solid, crisp, and nice flavour. Stood the drought well. Ready July 4. Cabbage.

15. Iceleaf (R. Veitch), **A.M.** August 13, 1895.—Foliage large, pale green, shining, and spreading; hearts large, solid, crisp, and of very good flavour. Stood the drought well. Ready June 26. Cabbage. This is a good selection of Royal Malta.

16. Jeffries' Little Queen (Hurst).—Foliage dark green, rather small and compact, and did not heart well, running quickly to seed. Ready June 20. Cos.

17, 18. Jumbo (Carter, Barr), **A.M.** July 5, 1901.—Foliage deep green, large, compact; hearts immense, solid, excellent flavour. Stood the drought well. Ready July 1. Cos. The largest Lettuce in the collection.

19. King Edward (R. Veitch).—Very similar to No. 7.

20. Largest of All (Masters).—Foliage large, pale green, spreading; hearts large, solid, and good flavour. Stood the drought fairly well. Ready June 20. Cabbage. The variety closely resembles 'American Deacon' and 'Vauxhall Defiance.'

21. Little Gem (Barr), **A.M.** June 20, 1901.—Foliage pale green, rather small and compact; hearts large, very solid, crisp, and of excellent flavour. A very good early variety. Ready June 15. Cabbage.

22. Long-standing White (Barr).—Foliage pale green, large, spreading; hearts of good size, moderately solid, and of fair flavour. Ready July 5. Cos. Very similar to Ivery's 'Nonsuch' and Dickson's 'Champion.'

23. New Endive-leaved (Carter).—Foliage deep green, and beautifully cut and divided; a very handsome variety, but it forms no heart.

24. New Yorker (Barr), **A.M.** July 5, 1901.—Foliage deep green, large, and spreading. Hearts of good size, very solid, and of excellent flavour. Stood the drought well. Ready July 5. Cabbage.

25. Paragon (Barr).—Same as No. 20.

26. Paris White (Hurst).—Foliage dark green and of medium size, compact. Hearts of moderate to large size, solid, crisp, and of excellent

flavour. Stood the drought well. Ready June 19. Cos. This very closely resembles Paris Grey Cos, which received an **A.M.** August 18, 1895.

27. Perfect Gem (R. Veitch).—Same as No. 12.

28. Perpetual (Carter).—Same as No. 14.

29. Queen of the Lettuces (Hurst).—Foliage pale green, tinged with red at the margins, compact. Hearts large, solid, and very good flavour. Stood the drought well. Ready June 20. Cabbage.

30. St. Albans All Heart (Hurst), **A.M.** June 20, 1901.—Foliage very dark green, large, compact. Hearts of moderate size, firm, and good flavour. Stood the drought well. Fine stock. Ready June 19. Cos.

31. Summer White (Carter).—Very similar to No. 26.

32, 33. Tom Thumb (Hurst, Barr), **A.M.** June 20, 1901; as a frame variety.—Foliage pale green, small, very compact. Hearts very solid, crisp, and of excellent flavour. Stood the drought fairly well. Ready June 14. Cabbage.

34. The Barnham (Barr).—Same as No. 1.

35. Virginia Solid-head (Masters). Foliage large and rather spreading, spotted and splashed with red. Hearts large, solid, and of good flavour. Stood the drought well. Ready June 19. Cabbage.

36. White Favourite (Barr).—Foliage deep green, rather spreading. Hearts very firm, crisp, and of good flavour. One of the best to withstand drought. Ready June 20. Cabbage.

37. Winter Giant (R. Veitch).—No use for spring or summer sowing, but excellent for autumn sowing to stand the winter. Cabbage.

38. Winter White Cos (Barr).—Foliage dark green, and of medium size; compact. Hearts large, solid, and of fair flavour. Stood the drought well. Ready June 20.

39. Wonderful (Hurst).—Foliage dark green and spreading. Hearts very large, solid, and of good flavour. Stood the drought moderately well. Ready June 26. Cabbage.

Radishes.

Sixteen stocks of Radish were received for the Salad trial, all of which were sown in a cold frame on March 7. Except on cold nights the lights were not put on the frames. The whole collection was taken up to the Drill Hall on May 7 and examined by the Fruit and Vegetable Committee.

1. Early Gem (J. Veitch).—Ready for use April 29. Roots longish oval, scarlet, tipped with white. Foliage moderate. A very crisp and pleasant-flavoured variety.

2. Ever Tender (R. Veitch).—Same as No. 3.

3. Gem (Barr).—Distinct from No. 1, being rounder, paler scarlet, but ready for use at the same time, and similar in foliage and flavour.

4. Krewson's Oblong Black (Masters).—Not true. Roots white.

5. Lily White (R. Veitch).—Ready for use April 30. Roots long, white. Foliage short and distinct. Crisp, and of very good flavour.

6. Mortlake Gem (Carter).—Ready for use April 29. Roots turnip-shaped, white, beautifully speckled and mottled with scarlet. Foliage very short. Crisp, and of good flavour. A very pretty variety.

7. Olive-shaped Extra Early Scarlet (J. Veitch).—Ready for use April 26. Roots deep round or olive-shaped. Foliage short. Excellent in all respects, and one of the earliest and best. This variety is the same as 'Deep Scarlet Olive-shaped,' which received a **F.C.C.** April 21, 1897.

8. Olive-shaped Extra Early White (J. Veitch).—Ready for use April 26. A white form of No. 7, and equally good and early. (*Syn.*) 'Forcing White Olive-shaped' and 'First of All White,' which received **A.M.** May 10, 1898.

9. Olive-shaped Jewel (Barr).—Ready for use April 29. Roots oblong, deep scarlet. Foliage remarkably short. Crisp and of good flavour. (*Syn.*) 'Olive-shaped Bright Red,' which received **A.M.** May 5, 1896. This variety is also known as 'Leafless,' probably from the exceeding smallness of the foliage.

10. Scarlet Queen (Barr).—Ready for use April 30. Roots long, scarlet tipped with white. Foliage rather large. Crisp and sweet in flavour.

11. Triumph (J. Veitch). Same as No. 6.

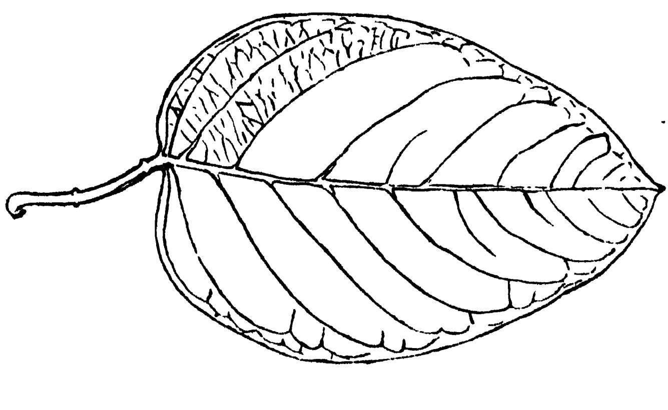
12. Turnip-shaped Extra Early Scarlet (J. Veitch).—Ready for use April 26. Roots scarlet. Foliage very short. Crisp and of excellent flavour; one of the best and earliest.

13. Turnip-shaped Extra Early White (J. Veitch).—Ready for use April 29. A white form of No. 12, but three days later in coming into use.

14. Turnip-shaped Early White (Barr).—Same as No. 13.

15. Turnip-shaped Scarlet Perfection (Barr).—Ready for use April 26. Roots deep, round, scarlet. Foliage very short. Crisp and excellent. Very similar to No. 7.

16. Wood's Frame White (R. Veitch).—Ready for use April 30. A white form of the well-known Wood's Frame.



REPORT ON DWARF FRENCH BEANS AT CHISWICK, 1901.

TWELVE stocks of Dwarf French Beans were received for trial, and were all sown on May 8, on a warm south border in rows three feet apart. With one exception they all made excellent growth, and cropped well. The Fruit and Vegetable Committee examined the stocks on two occasions.

A.M. = Award of Merit.

1. Dwarf Hybrid (J. Veitch).—Flowers white, produced in long clusters; pods long and broad; foliage large, on rather tall plants. A heavy and continuous bearer. Ready July 20.

2. Holborn Wonder (Carter).—Flowers pale, freely produced; pods long, thick, and almost stringless; foliage of medium size on moderately tall plants. Heavy crop. Ready July 20.

3. Invincible Dwarf Hybrid (J. Veitch).—Flowers pale pink, borne in long clusters; pods very long, broad, and slightly curved; foliage large, on tall robust plants. A heavy and continuous bearer. Ready July 20.

4. Magnum Bonum (Dean).—Flowers white, freely produced; pods long and straight; foliage large; plants tall and vigorous. Heavy crop. Ready July 20

5. Mont d'Or (Wood).—None of the seeds germinated.

6. Smythe's Fawn, **A.M.** August 13, 1901 (Dean). Flowers very pale pink or nearly white, abundantly produced; pods very long and straight; foliage large; plants tall. Very heavy crop. Ready July 19.

7. Smythe's Hybrid (Dean).—Not fixed, and requires further selection.

8. Smythe's Goliath (Dean).—Flowers reddish pink, produced in small clusters; pods long and nearly straight; foliage of medium size; plants tall and spreading. Good crop. Ready July 21.

9. Smythe's Red Rover (Dean).—Flowers red, produced in moderate clusters; pods very long and nearly straight; foliage large and spreading; plants tall. Heavy crop. Ready July 19.

10. Smythe's Speckled (Dean).—Flowers very pale pink, borne in great clusters; pods long and straight; foliage very large and spreading; plants tall. Heavy crop. Ready July 20.

11. Surrey Prolific, **A.M.** August 13, 1901 (Dean).—A larger-podded, earlier, and improved form of No. 4, from which it is probably a sport or selection. Ready July 18.

12. Wood's Centenary (Woods).—Flowers pale yellow, produced in small clusters; pods long, broad, straight, white; beans white, blotched with black; foliage of medium size; plant dwarf and compact. Heavy crop. Ready July 18.

BROAD BEANS.

1. Green Leviathan (Carter).—Immense long pods of the Long-pod type.

2. Improved Green Long-pod (J. Veitch).—A very good selection of this well-known type.

REPORT ON POTATOS AT CHISWICK, 1901.

FORTY-EIGHT stocks of Potatos were sent for trial, and a few well-proved varieties were grown side by side for comparison. The whole collection was planted on April 24 in rows three feet apart, the "sets" being eighteen inches apart in the rows, on ground that had been ridge-trenched the previous autumn. A good supply of decayed-leaf mould, ashes from burnt garden refuse, and old potting soil were incorporated when trenching. All the stocks made good growth, and the majority produced good crops. The Fruit and Vegetable Committee examined the collection on three occasions, and they decided that the value of the trial would be greatly enhanced if the best late varieties were kept until December 12 and then cooked, after being stored about two months, which was done. The following varieties, by reason of their heavy crops and good appearance, were selected for cooking to test their quality, viz.:

Burmah Beauty.	General French.
Carltonia.	Glory of Denbigh.
Chancellor.	Improved Kidney.
Duchess of Buccleuch.	Ker's B.
Early Jubilee.	King of the Earlies.
Early Wonder.	Loveland's Kidney.
Ellington's Prolific.	Sharpe's Express.
Fylde Wonder.	The Crofter.
General Buller.	The Factor.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.
× × = Commended.

1. Beehive (Ker).—See vol. xxv. page 387.

2. Brook's Early Market (J. Veitch).—Flattish oval; white; eyes rather deep; good shape, moderate to large in size; fair crop, free from disease; haulm short and sturdy. Second early.

3. Burmah Beauty (Sharpe).—Round; white; eyes deep; large; very heavy crop, slightly grown out; haulm tall and vigorous. Late; a promising variety.

4. Carltonia, **A.M.** December 17, 1901 (Taylor).—Round; white, eyes shallow; handsome, large; splendid crop, free from disease; haulm moderate and sturdy. Late.

5. Challenge, **A.M.** September 6, 1898 (Dean).—Round; white, russety skin; eyes shallow; handsome; heavy crop, free from disease; haulm tall and robust. Mid-season or late.

6. Chancellor, **F.C.C.** August 20, 1885 (Dean).—Round; white and russety; eyes full; handsome; medium size; free from disease; heavy crop; haulm moderate and sturdy. Mid-season or late.

7. Churchill's Prolific (Churchill).—Round; red; eyes very deep; not

of good shape; large; moderate crop, slightly diseased; haulm tall and strong. Late.

8. Cigarette (Hurst).—See vol. xxv., page 168.

9. Devonian, **A.M.** September 6, 1898 (R. Veitch).—Kidney; white; eyes full; handsome; medium size; heavy crop, free from disease; haulm short and sturdy. Late.

10. Duchess of Buccleuch (Ker).—See vol. xxv., page 378.

11. Duchess of Teck (Sharpe).—Oval or pebble shape; white; eyes shallow; medium size; moderate crop, free from disease; haulm short and sturdy. Second early.

12. Early Jubilee, **A.M.** August 13, 1901 (Dickson & Robinson).—Kidney; white; eyes full; pretty shape; medium size; heavy crop, free from disease; moderate sturdy haulm. First early.

13. Early Favourite (J. Veitch).—Round; white, russety; handsome; rather large; eyes shallow; heavy crop, slightly diseased; haulm moderate and sturdy.

14. Early Market (J. Veitch).—Round; white, flaked and blotched with purple, especially at the eye, which is full; handsome form; medium size; moderate crop, free from disease; short sturdy haulm.

15. Early Wonder (Johnson).—Flattish round; white; eyes full medium size; moderate crop, free from disease; haulm short and sturdy. This should prove an excellent variety for frame culture, by reason of its great earliness and short haulm.

16. Eclipse (J. Veitch).—Round; pale pink; eyes shallow; good shape, large; heavy crop, free from disease; haulm rather tall. Second early.

17. Ellington's Prolific, **A.M.** December 17, 1901 (Ellington).—Round; white with pink eyes, which are rather deep; medium size; very heavy crop; free from disease; haulm moderate and sturdy. Late.

18. Ellington's Purple King (Ellington).—Round; purple; eyes rather deep; small; very heavy crop, free from disease; haulm moderate. Late.

19. Express (Johnson).—Flattish round; white; eyes shallow; good shape, medium size; moderate crop, free from disease; haulm short. Early.

20. Fylde Wonder, **A.M.** December 17, 1901 (Troughton).—Round; white, russety; handsome form; eyes shallow; heavy crop, free from disease; haulm moderate and sturdy. Late.

21. General Buller, **A.M.** October 1, 1901 (R. Veitch).—Flattish round; white, rough russety skin; eyes shallow; handsome; medium size; very heavy crop, free from disease; haulm moderate and very sturdy. Mid-season or late. This is distinct from 'General Buller' sent by Messrs. Ker in 1900.

22, 23. General French, **A.M.** October 1, 1901 (Barr, Hurst).—Round; white and russety; eyes shallow; good shape; very heavy crop, free from disease; haulm moderate. Late.

24. Glory of Denbigh, **A.M.** August 13, 1901 (Hughes).—Round; white; eyes shallow; handsome; medium size; heavy crop, free from disease; haulm short and sturdy. Early.

25. Green's Favourite (Green).—Oval; white; eyes full, small, much

grown out; heavy crop, free from disease; haulm tall and vigorous. Late.

26. Improved Kidney, **A.M.** December 17, 1901 (Dobbie).—Flat kidney; white and russety; handsome; eyes shallow; very heavy crop, free from disease; haulm tall and strong. Late. This variety was remarkably good when cooked.

27. Ker's B. **A.M.** December 17, 1901 (Ker).—See vol. xxv., page 379.

28. King of the Earlies, × × August 2, 1901 (Slowe).—Flat round; white and russety; eyes shallow; handsome; medium size; good crop, free from disease; haulm short and sturdy. A variety under this name received an **A.M.** September 2, 1892, and sent by Mr. Ridgewell.

29, 30. Lord Dundonald (Barr, Hurst).—See vol. xxv., page 379.

31. Loveland's Kidney (Dean).—Flat Kidney; white and russety; eyes full; good shape; medium size; light crop, free from disease; haulm moderate and sturdy. Late.

32. New Excelsior (Dobbie).—Round; white; eyes shallow, small; very heavy crop, slightly diseased; haulm rather tall. Late.

33. New Seedling Kidney (Hurst).—Flattish kidney; white; eyes shallow; handsome; medium size; moderate crop, free from disease; haulm tall and strong. Late.

34. New Seedling Round (Hurst).—Round; white; eyes shallow; medium size; good shape; heavy crop, free from disease; haulm short and sturdy. Second early.

35. Omega (Sharpe).—Round; white; eyes shallow; variable in shape, large; very heavy crop, free from disease; haulm tall and vigorous. Late.

36. Pilling's Favourite (Troughton).—Round; white and rough in appearance; eyes deep; very large; heavy crop, free from disease; haulm tall and very strong. Late.

37. Prime Minister (Dean).—Flat oval; white; eyes shallow; medium to large; handsome; moderate crop, free from disease; haulm tall. Late.

38. Prosperity (Laxton).—Round; white; eyes deep; medium to large; good shape; heavy crop, free from disease; haulm tall and strong. Late.

39. Red Perfection (R. Veitch).—See vol. xxv., page 380.

40. Robust (J. Veitch).—Oval or pebble shape; white, russety; eyes full; handsome; medium size; light crop, free from disease; haulm tall and vigorous. Late.

41. Selected Early Ashleaf (Barr).—A very good selection of this favourite old variety.

42. Sharpe's Express, **A.M.** August 13, 1901 (Sharpe).—Kidney; white; eyes full; medium size; very handsome; heavy crop, free from disease; haulm short and sturdy. An excellent first early variety, and quite distinct from No. 19.

43. Sleaford Hero (Sharpe).—Round; white, slightly tinged with pink; eyes rather deep; large; moderate crop, free from disease; short sturdy haulm. Early.

44. The Factor, **A.M.** October 1, 1901 (Dobbie).—Round; white,

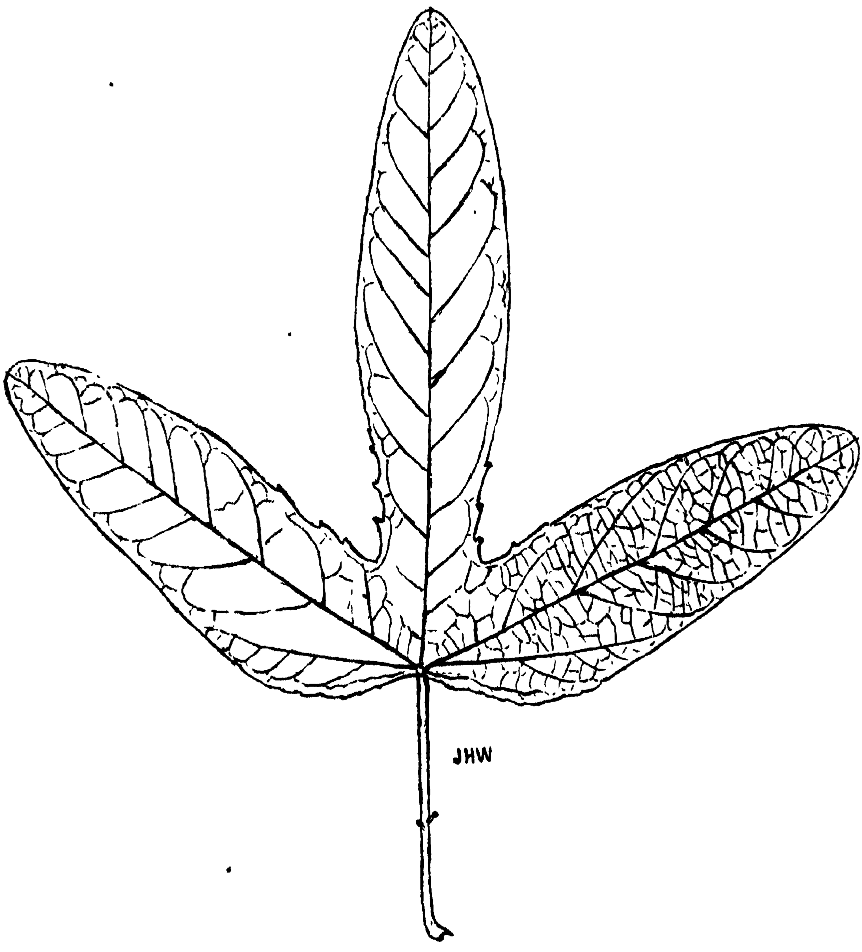
russety; eyes shallow; medium size; good shape; very heavy crop, free from disease; haulm rather tall and robust. Late.

45. The Crofter (Dean).—Flat round; white, russety; eyes shallow; large; handsome; moderate crop, free from disease; haulm tall and robust. Late.

46. Trout Kidney (Stanley).—Dark purple; eyes full; uneven in size; good shape; light crop, free from disease; haulm tall and vigorous. Late.

47. Unnamed (Stanley).—Very similar to Magnum Bonum.

48. Webb's Industry (Dean). Round; white; eyes full; medium size; handsome; good crop, free from disease; haulm moderate and sturdy. Mid-season or late.



REPORT ON CABBAGES AT CHISWICK, 1901.

SEVENTY-SIX stocks of Cabbage were sent for trial, and sown in frames on March 5, 1901, and, after being pricked out, were planted on a well-manured quarter, 3 feet between the rows, and 2 feet apart in the rows. All made good growth, and were examined by the Fruit and Vegetable Committee on three occasions. To enhance the value of the trial it was decided to sow seed of all the stocks early in August to test their relative merits for spring cutting ; this was done. All the stocks again germinated well, and the whole collection was planted out at the end of September. All made nice growth until the autumn fogs set in, and eventually the heavy fogs of January and February, 1902, destroyed the whole collection.

F.C.C.=First-class Certificate.
A.M.=Award of Merit.

1. All The Year Round (Masters).—A form of No. 41. Stock mixed.

2. Autumn King (Masters).—Stock very mixed.

3. Beaconsfield, **A.M.** June 14, 1891 (J. Veitch).—Hearts of medium size, conical, firm, and of good shape, with a moderate spread of outer leaves. Ready for use August 9.

4. Best of All, **A.M.** August 13, 1901 (Barr).—Hearts rather large, of a sugar-loaf shape, very compact and firm, with a moderate spread of outer leaves. An excellent variety for summer use. Ready for use July 17.

5, 6. Cattell's Reliance (Nutting, J. Veitch).—Two distinct varieties were sent under this name. One had small, deep, round hearts, and the other had bluntly pointed hearts; the latter being the true variety, which is somewhat similar to 'Nonpareil.' Both were ready for use July 24.

7. Covent Garden (Carter).—Hearts large, conical, firm, with large spreading outer leaves. Ready for use August 9.

8. Criterion (Barr).—Hearts of medium size, bluntly conical, firm, compact, with a small spread of outer leaves. Ready for use July 18.

9. Dobbie's Earliest (Dobbie).—Hearts large, firm, conical, with a moderate spread of outer leaves. A very good variety for summer cutting. Ready for use July 18.

10. Dwarf Drumhead (Watkins & Simpson).—Hearts very large, firm, flat round, with a very large spread of outer leaves, and requires a lot of space. Very useful for autumn and winter cutting. Ready for use August 9.

11. Dwarf Drumhead Autumn (Watkins & Simpson).—A paler green and later form of No. 10.

12. Dwarf Spring Cutting (Barr).—Hearts large, bluntly conical, firm, with large spreading outer leaves. Ready for use July 24.

13. Early Conical (Dickson & Robinson).—Not conical. A very good early form of No. 10 ; excellent for summer cutting. Ready for use July 20.

14. Early Evesham (Nutting).—Hearts rather large, firm, conical,

with moderately spreading foliage on dwarf plants. A good summer variety. Ready for use July 20.

15. Early Étampes (Nutting).—Hearts large, bluntly conical, firm, with moderately spreading outer leaves. A very useful variety for summer cutting. Ready for use July 18.

16, 17. Early Feltham (Watkins & Simpson, Barr).—Hearts very large, conical, firm; plants tall, with large spreading outer leaves. Ready for use July 18.

18. Early Flat Dutch (Carter).—Same as No. 10.

19. Earliest of All (R. Veitch).—Hearts of medium size, deep round, firm, small spread of outer leaves. A very good summer variety. Ready for use July 20.

20. Earliest of All (Dickson & Robinson).—Hearts large, bluntly conical, firm; plants very dwarf and compact. Ready for use July 16. Distinct from No. 19.

21. Early Market (Watkins & Simpson).—Hearts very large, conical, firm, with a large spread of outer leaves. Ready for use July 30. A good summer variety.

22. Early Jersey Wakefield (Masters).—Hearts of medium size, very pointed, firm, compact, with a very small spread of outer leaves. Ready for use July 17.

23, 24, 25. Early Offenham (R. Veitch, Watkin & Simpson, Hurst).—An improved and excellent selection of Enfield Market. Ready for use July 19.

26. Early Rainham (Hurst).—Hearts large, conical, firm, with a small spread of upright leaves. Ready for use July 20. A good summer variety.

27. Early Spring (Carter).—Same as No. 13.

28. Early Warwick (Nutting).—Hearts large, bluntly conical, firm; very dwarf, with large spreading outer leaves. Ready for use July 25. A good summer variety.

29. Eclipse (Barr).—Stock mixed.

30, 31. Ellam's Dwarf Early Spring, **F.C.C.** April 8, 1884 (J. Veitch, Watkins & Simpson).—Hearts large, conical, moderately firm, with large spreading outer leaves. Ready for use July 29. A well-known variety and valuable for spring cutting, but not one of the best for spring sowing and summer use.

32, 33, 34. Enfield Market (J. Veitch, Watkins & Simpson).—Hearts large, conical, firm, with large spreading outer leaves. Ready for use July 21.

35, 36. First and Best (Hurst, Dobbie).—Hearts very large, conical, very firm, with a moderate spread of outer leaves. Ready for use August 1. A good summer variety.

37. Harbinger Drumhead (Hurst).—Hearts small, round, very firm; on tall plants, with a moderate spread of outer leaves. Ready for use August 8. A very fine late summer and autumn variety.

38. Improved Winningstadt, **A.M.** November 20, 1900 (Dobbie).—Hearts of medium size, pointed, very firm, with a moderate spread of outer leaves on very dwarf plants. Ready for use August 9. An excellent late summer and autumn variety.

39. Incomparable (J. Veitch).—Hearts large, conical, moderately firm, with large spreading outer leaves. Ready for use August 9.

40. Johnson's Special (Johnson).—Did not heart well.

41. Large Drumhead (Watkins & Simpson).—A taller and larger form of No. 10, and the same as 'Christmas Drumhead,' which received an **A.M.** December 12, 1893.

42. Large Early Flat Dutch (Carter).—Hearts very large, flat round, very firm, with large spreading outer leaves, similar in form to No. 10, but distinct in the foliage. Ready for use July 25.

43. Little Queen, **A.M.** August 13, 1901 (Barr).—Hearts of medium size, conical, very firm, compact, with a small spread of outer leaves, and very dwarf. Ready for use July 16. One of the best summer varieties.

44. Little Red Gem (Dobbie).—Hearts small, flat round, firm; foliage small and compact; very dwarf. Ready for use August 9. A very good pickling variety.

45. London Market (Nutting).—Hearts large, moderately firm, with large spreading leaves. Ready for use July 31.

46. Mammoth Beefheart (Carter).—Hearts of medium size, bluntly conical, firm, with a small spread of outer leaves; dwarf and compact. Ready for use August 9.

47. Marblehead Mammoth (Carter).—Same as No. 41.

48. Market Garden (Johnson).—Very similar to Nos. 30, 31.

49. Mein's No. 1 (Watkins & Simpson).—Hearts very large, conical, firm, with large spreading outer leaves. Ready for use July 21. A good summer variety.

50. Miniature Red (Barr). Same as No. 44.

51. No. 1 (Proctor).—Very similar to No. 49.

52 to 59. Nonpareil (J. Veitch, Watkins & Simpson, Hurst, Nutting). Hearts of medium size, conical, very firm, with medium-sized spreading outer leaves. Ready for use July 16. Very true stocks.

60. Prince's Improved Nonpareil, **A.M.** August 13, 1901 (Nutting).—A very dwarf, handsome, and greatly improved form of Nos. 52 to 59. Ready for use July 16.

61. Perfect Gem (Dobbie).—Hearts small, deep round, firm, very compact, with a small spread of outer leaves. Ready for use July 25. A very good summerr variety.

62. Pink Heart (Masters).—A tall-growing variety that did not form any heart.

63. Redland Early Drumhead (Masters).—Same as No. 10.

64. Red Dutch (J. Veitch).—Hearts large, flat, round, very firm, with a moderate spread of outer leaves. Fine deep colour. Ready for use August 23.

65. Red Drumhead (Watkins & Simpson).—A slightly larger form of No. 64.

66. Robert Wrench (R. Veitch).—A selection of Nos. 32, 33, 34.

67. Selected Drumhead (Dobbie).—Same as No. 10.

68. Selected Large York (Dobbie).—Hearts large, conical, firm, with large spreading outer leaves. Ready August 11. A good summer variety.

69. St. Martin's, **A.M.** November 7, 1899 (J. Veitch).—Hearts of

medium size, round, firm, with moderate leaves on tall plants. Ready for use July 20. A very good summer and autumn variety.

70. Stonemason (Carter).—Very similar to No. 10.

71, 72. Wheeler's Imperial (Hurst, Wheeler).—A good selection of Nos. 52 to 59.

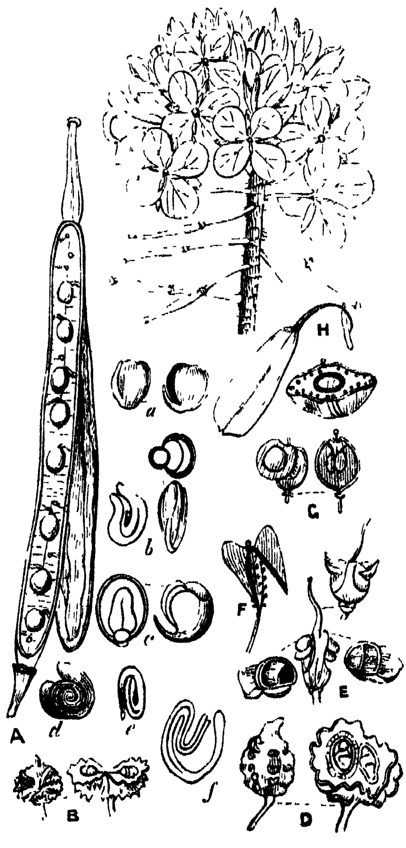
SAVOY.

73. Perfect Gem (Dobbie).—Hearts small, very firm, with a small spread of outer leaves on dwarf plants. Ready for use September 4.

74. Pretoria (Carter).—Hearts large, firm, with a moderate spread of outer leaves on very dwarf plants. Ready for use September 10.

75. Selected Green Curled (Dobbie).—A good selection of this well-known large variety.

76. Selected Drumhead (Dobbie).—Hearts very large, firm, with rather large spreading outer leaves. Ready for use September 10.



BOOKS PRESENTED DURING THE YEAR 1901.

Presented by J. Douglas, Esq., V.M.H.

"Hortus Cantabrigiensis," by J. Donn, Ed. 9, by F. Pursh.
"The Anatomy of Plants," by Nehemiah Grew.

Presented by Rev. Prof. G. Henslow, V.M.H.

"The Story of Wild Flowers," by Rev. Prof. G. Henslow.
"Poisonous Plants in Field and Garden," by Rev. Prof. G. Henslow.
"The Floral World," 8 vols.
"Annals of Horticulture," 1846.

Presented by Dr. M. C. Cooke.

"Handbook of British Hepaticæ," by Dr. M. C. Cooke.
"Handbook of Australian Fungi," by Dr. M. C. Cooke.
"Romance of Low Life amongst Plants," by Dr. M. C. Cooke.
"Grevillea Atlas," by Dr. M. C. Cooke.
"Synopsis Pyrenomycetum," by Dr. M. C. Cooke.
"Clavis synoptica Hymenomycetum Europæorum," by Dr. M. C. Cooke and Dr. L. Quelet.
"Mushroom Culture," by W. Robinson.
"The Potato Plant," by A. Smee.
"The Garden Mushroom," by J. Abercrombie.
"A Monograph of the British Hypomyces," by C. B. Plowright.

Presented by the Director, Royal Gardens, Kew.

"Flora of Tropical Africa," viii., pts. 1 and 2.
"Flora Capensis," v., pt. 1.

"Hooker's Icones Plantarum," vii. pt. 4, viii. pt. 1, presented by the Bentham Trustees.

"Alpine Plants," by W. A. Clark, presented by the author.
"Hardy Border Flowers the Year Round," by W. Smyth.

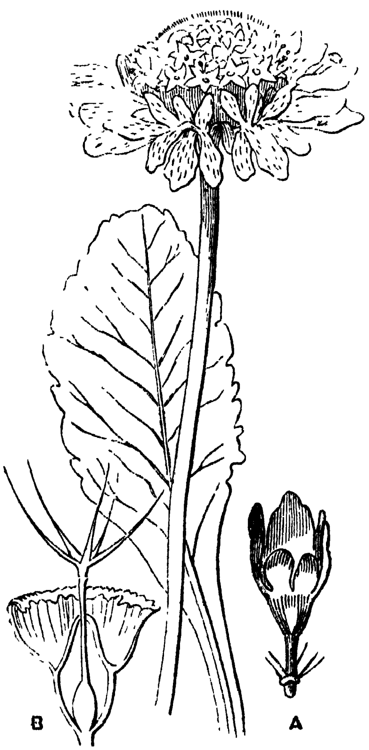
BOOKS PURCHASED DURING THE YEAR 1901.

"Irrigation and Drainage," by F. H. King.
"The Principles of Agriculture," ed. by L. H. Bailey.
"The Principles of Fruit-Growing," by L. H. Bailey.
"Our Forests and Woodlands," by J. Nisbet.
"Flore descriptive et illustrée de la France, de la Corse, et des Contrées limitrophes," par L'Abbé H. Coste, vol. i.
"Flora Pyrenæa," vol. iii., by P. Bubani, ed. O. Penzig.
"A Practical Guide to Garden Plants," by J. Weathers.
"Les Cultures Coloniales. Plantes alimentaires," par H. Jumelle.
"Disease in Plants," by Prof. H. Marshall Ward.
"Grasses. A Handbook for Use in the Field and Laboratory," by Prof. H. Marshall Ward.
"Open-Air Gardening," ed. by W. D. Drury.
"La Vigne et le Vin," par P. Jamain, G. Bellair, et C. Moreau.
"Blühende Kakteen (Iconographia Cactacearum)," Lief. 1–5, herausg. von Prof. K. Schumann.
"Organographie der Pflanzen," ii. Teil, 2 Heft, i. Teil, von K. Goebel.
"The Century Supplement to the Dictionary of Gardening," G–Z, by G. Nicholson.
"Genera Siphonogamarum ad systema Englerianum conscripta," fasc. 3, ab auct. Dr. C. G. De Dalla Torre et Dr. H. Harms.
"Cyclopedia of American Horticulture," vol. 3, by L. H. Bailey.
"Les Arbres fruitiers et la Vigne," par. P. D'Aygalliers.
"Les Plantes tinctoriales et leurs principes colorants," par V. Thomas.
"Symbolæ Antillanæ," vol. ii., fasc. 3, ed. I. Urban.
"Die Mutationstheorie," Bd. i., Lief. 2 & 3, von Hugo de Vries.
"Icones Bogorienses," fasc. 4.
"Conspectus Floræ Græcæ," vol. i., fasc. 3, auctore E. de Halácsy.

"Die Vegetation der Erde," vol. iv., herausg. von. A. Engler und O. Drude.
"Orchidacearum Genera et Species," fasc. 2–16, exposuit F. Kraenzlin.
"Monographieen africanischer Pflanzen-familien und Gattungen," herausg. von. A. Engler, vi. "Anonaceæ" bearbeitet von A. Engler und E. Diels.
"Pyrus Malus Brentfordiensis: or a Concise Description of Selected Apples," by H. Ronalds.
"Pomona Herefordiensis; containing coloured Engravings of the old Cider and Perry Fruits of Herefordshire," by T. A. Knight.
"British Vegetable Galls," by E. T. Connold.
"Pomona, or the Fruit Garden Illustrated," by Batty Langley.

BOOKS REVIEWED AND DEPOSITED IN THE LIBRARY, 1901.

"Wall and Water Gardens," by Miss Jekyll.
"Lilies for English Gardens," by Miss Jekyll.
"Greenhouse Construction and Heating," by B. C. Ravenscroft.
"The Art and Craft of Garden Making," Ed. 2, by T. H. Mawson.
"Sander's Orchid Guide."
"Thompson's Gardener's Assistant," Div.-Vol. 1-4, ed. W. Watson.
"Quick Fruit Culture," by J. Simpson.
"Calendar of Flowering Trees and Shrubs," by H. Hoare.
"Flora of Bournemouth," by E. F. Linton.
"The British Gardener," by W. Williamson.
"Gardening for Beginners," by E. T. Cook.
"Elementary Botany," by Prof. Groom.
"Illustrations of the Royal Botanic Gardens, Kew," by E. J. Wallis.
"The Book of the Grape," by H. W. Ward.
"The Book of Old-Fashioned Flowers," by H. Roberts.
"The Book of the Greenhouse," by J. C. Tallack.
"The Book of Asparagus," by C. Ilott.
"Gardens Old and New." (Country Life Library).



DONORS OF SEEDS, PLANTS, &c., TO THE SOCIETY'S GARDENS AT CHISWICK DURING THE YEAR 1901.

ALDENHAM, Lord, Aldenham House, Elstree. Twenty-seven varieties of Michaelmas Daisies. These will be reported upon next year.

BARR, Messrs., Covent Garden. Vegetable and Flower Seeds. Collection of Phloxes and Gladiolus. See pp. 273, 604, 607. The Phloxes will be reported upon in a subsequent issue.

BEDDOME, Col., F.L.S., Sispara, West Hill, Putney. Seeds of Aconitum ferox. Being grown on for distribution to Fellows.

BENNETT-POE, J. T., Homewood, Cheshunt. Seeds of Ochna multiflora and Plants of Nephrolepis Duffii. Being grown on for distribution to Fellows.

BERMINGHAM, M., Hugo Street, Leek. Tomato Seed. Will be tried in 1902.

BIRD, Rev. M. C. H., Brunstead Rectory, Stalham, Norwich. Three packets of Seeds. Proved to be of no value.

BONAVIA, Dr., Worthing. Seeds of an Italian Gourd and Chitla Melon. See p. 862.

BOURNE, R. W., 18 Hereford Street, South Kensington. Six packets of Seeds. Distributed as Plants to Fellows.

BRETON, Miss, Sandhurst, Berks. Nine packets of Seeds. Distributed as Plants to Fellows.

BURLINGHAM, J. C., 67 Vancouver's Road, Forest Hill. One tin of Paint. See p. 861.

BUSH, Messrs., Ash Grove, Hackney. Fumigating Compound, and Spraying and Sponging Compound. See p. 861.

CARTER, Messrs., High Holborn. Vegetable and Flower Seeds. See pp. 273, 607. A report on Cabbages will appear in a subsequent issue.

CHANCELLOR, Messrs., 13 Clerkenwell Road, E.C. One pot of Velure paint. See p. 861.

CHARLTON, Messrs., Morpeth. Six Plants of Gooseberry 'Victoria.' Planted in the collection at Chiswick.

CHURCHILL, J., Wareham. Seed Potatos. See p. 871.

COOLING, Messrs., Bath. Cabbage Seed. A report on Cabbages will appear in a subsequent issue.

CORBETT, Hon. Mrs., The Pool Farm, Adderley, Market Drayton. One Dracæna. For stock.

CULLEN, F. J., Witham, Essex. Culinary Peas. See p. 273.

DARLING, T., Adderstone House, Berwick-on-Tweed. One bag of Rose Manure. See p. 861.

DEAN, A., Richmond Road, Kingston. Beans and Potatos. See pp. 870, 871.

DEAN, R., Ranelagh Road, Ealing. Three packets of Balsam Seed. Received late.

DICKSON & ROBINSON, Messrs., Manchester. Culinary Peas, Cabbages, and Seed Potatos. See pp. 273, 872. A report on Cabbages will appear in a subsequent issue.

DIRECTOR, Botanic Gardens, Krakowi. Seventeen packets of Seeds. Distributed as plants to Fellows.

DIRECTOR, Royal Gardens, Kew. Seeds of Trees, Shrubs, Herbaceous Plants, and small Palm Plants. Being grown on for distribution to Fellows.

DOBBIE, Messrs., Rothesay. Seed Potatos and Cabbage Seed. See p. 873. A report on Cabbages will appear in a subsequent issue.

DOUGLAS, JAS., Great Bookham, Surrey. Carnation Seed and Plants of Carnation 'Old Chelsea.' Being grown on for distribution to Fellows.

ECKFORD, H., Wem. Five packets of Hybrid Peas. See p. 280.

EDMONDS, Miss, Wiscombe Park, Colyton. Nelumbium Plants. Received in poor condition, and failed to grow.

ELLINGTON, W., Mildenhall, Suffolk. Seed Potatos. See p. 872.

FORBES, J., Hawick. Collection of Phloxes. A report on these will appear next year.

GOODY, J., Belchamp St. Paul's, Clare, Suffolk. Seeds of Beans. Tree Pea 'Eccentric' and Tomato Plants. See p. 279. The Beans failed to germinate, and the Tomatos will be tried in 1902.

GREEN, R. W., Wisbech. Seed Potatos. See p. 872.

GREGSON, Mrs., Hurtwood, Cranleigh, Guildford. Two Dracænas. For stock.

HAINWORTH, H., 54 St. John's Park, Blackheath. Two Dracænas. For stock.

HALL, J. M., Pontardulais. Onion Seed. See p. 863.

HARRIS, A., Mavendon, Woburn Sands. Seed of variegated Sprouting Broccoli. See p. 862.

HARRISON, Messrs., Leicester. Six packets of Cabbage Seed. A report on these will appear in a subsequent issue.

HUGHES, R. D., Denbigh. Seed Potatos. See p. 872.

HURST, Messrs., 152 Houndsditch, E.C. Vegetable Seeds. See pp. 866-878. A report on Cabbages will appear in a subsequent issue.

HARTOG, Professor, Cork. Hybrid Abutilon plants.

HUDSON, JAS., V.M.H., Gunnersbury House, Acton. One plant of Begonia 'Mrs. Leopold de Rothschild.' For stock.

JOHNSON, Messrs., Boston. Seed Potatos, Culinary Peas and Cabbage Seed. See pp. 273, 872. A report on Cabbages will appear in a subsequent issue.

KENT & BRYDON, Messrs., Darlington. Vegetable Seeds. See p. 865.

KENYON-SLANEY, Lady MABEL, Hatton Grange, Shifnal. Seedling Carnations. These will be reported upon at the end of next season.

KITSON, C. W., The Chantry, Netherbury. Seeds of Leucadendron argenteum. Failed.

LAWRENCE, Sir TREVOR, Bart., Burford, Dorking. Seeds and plants. Being grown on for distribution to Fellows.

LAXTON, Messrs., Bedford. Culinary Peas and Seed Potatos. See pp. 273, 873.

LEMOINE, M. V., Nancy. Collection of Phloxes. A report on these will appear next year.

LISTER, Messrs., Rothesay. Tomato Seed. Will be tried in 1902.

LOW, Messrs., Enfield. One Vine 'Chasselas Napoleon.' Planted in the collection at Chiswick.

LYNCH, R. J., Botanic Garden, Cambridge. Sixty packets of Seeds. Being grown on for distribution to Fellows.

McDOUGALL, Messrs., 10 Mark Lane, E.C. Fumers, fumigating sheets, and Tobacco powder. See p. 861.

NEWPORT, Messrs., Hillingdon Heath, Uxbridge. Plants of Lobelia 'Newport Model.'

NUTTING, Messrs., 106 Southwark Street, S.E. Eight packets of Cabbage Seed. A report on these will appear in a subsequent issue.

PAUL, Messrs., Waltham Cross. Three plants of Dracæna indivisa For stock.

PERRY, AMOS, Winchmore Hill. Hardy plants. Planted in the collection at Chiswick.

PHILLPOTS, E., Cosdoune, Torquay. Twelve packets of Seeds. Distributed as plants to Fellows.

POPE, Messrs., Birmingham. One packet of Cabbage Seed. A report on this will appear in a subseqnent issue.

PROCTOR, Messrs., Chesterfield. Hybrid Tea Roses and Cabbage Seed, both of which will be reported upon in a subsequent issue.

PROUDLOCK, R. L., Botanic Gardens, Ootacamund. Thirty two packets of Seeds Distributed as plants to Fellows.

SHARPE, Messrs., Sleaford. Culinary Peas and Seed Potatos. See pp. 273, 871.

SINCLAIR, Messrs., 19 Eldon Street, Finsbury, E.C. Triplex syringe and Diffuser syringe. See p. 861.

SLOWE, R., Kimbolton. Seed Potatos. See p. 873.

SMITH, Messrs., Worcester. Collection of Hepaticas. Planted on the Rockery at Chiswick.

SMITH, Rev. CLEMENTI, St. Andrew's Rectory, E.C. Eleven packets of Seeds. Distributed as plants to Fellows.

STANLEY, W., Mary's Bourne, Andover, Hants. Seed Potatos. See p. 874.

SUTTON, Messrs., Reading. Culinary Peas, Climbing Beans, and Christmas Rhubarb. See pp. 273, &c.

TABRUM, B., Norsey Manor, Billericay, Essex. Ten packets of Seeds.

TAYLOR, A., Brougham, Penrith. Seed Potatos. See p. 871.

TROUGHTON, W., Preston. Seed Potatos. See p. 873.

VEITCH, Messrs. J., Chelsea. Vegetable and Flower Seeds, and plants of hybrid Tea Roses. See pp. 273, 864. A report on Roses will appear in a subsequent issue.

VEITCH, Messrs. R., Exeter. Vegetable and Flower Seeds. See pp. 273, 607.

VILMORIN, Messrs., Paris. Artichokes. See p. 862.

WALLACE, J., North Runcton, King's Lynn. Cucumber Seed. See p. 865.

WATKINS & SIMPSON, Messrs., 12 Tavistock Street, Covent Garden. Vegetable and Flower Seeds. See pp. 273, 607.

WELCHMAN, Miss E., Down Lodge, Epsom. Seeds of Testudinaria elephantipes. Distributed as plants to Fellows.

WHEELER, H. J., Warminster, Wilts. Onion and Cabbage Seeds. See p. 868. A report on Cabbages will appear in a subsequent issue.

WILKS, Rev. W., Shirley Vicarage, Croydon. Collection of German Irises. Distributed to Fellows.

WOOD, J., Penrith. Dwarf Bean Seeds. See p. 870.

WRIGHT, Messrs., Mansfield. Culinary Peas. See p. 273.

NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

JUDGING by the number of appreciative letters received, the endeavour, commenced last year, to enlarge the usefulness of the Society's Journal, by giving an abstract of current Horticultural and Botanical periodical literature, has met with success. It has certainly entailed vastly more labour than was anticipated, and should therefore make the Fellows' thanks to all who have helped in the work all the more hearty.

That anything approaching perfection either in method or execution should have been achieved as yet is not to be expected, but the Editor desires to express his most grateful thanks to all who co-operate in this work for the very large measure of success already attained, and he ventures to express the hope that they will all strictly adhere to the general order and scheme of working, as the observance of an identical *order* can alone enable the Editor to continue to cope with the work. The order agreed on was as follows :—

1. To place first the name of the plant, disease, pest, &c., being noticed ; and in this, the prominent governing or index word should always have precedence.

2. To place next the name, when given, of the author of the original article.

3. Then, the abbreviated form of the name of the journal, &c., in which the original article appears, taking care to use the abbreviation which will be found on pp. 885–6.

4. After this, a reference to the number, date, and page of the journal in question.

5. If an illustration be given, to note the fact next, as "fig.," "tab.," or "plate."

6. After these preliminary necessities for making reference to the original possible for the reader, the abstract or digest should follow, ending up with the initials of the contributor affixed at the close of each Abstract or Note.

NAMES OF THOSE WHO HAVE KINDLY CONSENTED TO HELP IN THIS WORK.

Boulger, Professor G. S., F.L.S., F.R.H.S.
Bowles, E. A., F.R.H.S.
Burbidge, F. W., M.A., V.M.H.
Chapman, H., F.R.H.S.
Chittenden, F. J., F.R.H.S.
Cook, E. T., F.R.H.S.
Cooke, M. C., M.A., LL.D., A.L.S., F.R.H.S.
Dod, Rev. C. Wolley, M.A., F.R.H.S.
Druery, C. T., V.M.H., F.L.S., F.R.H.S.
Farmer, Professor J. B., M.A., F.R.H.S.
Goldring, W., F.R.H.S.
Groom, Professor Percy, M.A., D.Sc., F.L.S., F.R.H.S.
Hartog, Professor Marcus, D.Sc., M.A., F.L.S., F.R.H.S.
Hawes, E. F., F.R.H.S.
Hay-Currie, C., F.R.H.S.
Henslow, Rev. Professor Geo., M.A., F.L.S., F.R.H.S., V.M.H.
Hodgson, M. L., F.R.H.S.
Hooper, Cecil, M.R.A.C., F.R.H.S.
Houston, D., F.L.S., F.R.H.S.
Hurst, Captain C. C., F.L.S., F.R.H.S.
Kent, A. H., A.L.S., F.R.H.S.
Lynch, R. Irwin, A.L.S., F.R.H.S.
Massee, Geo., F.L.S., F.R.H.S.
Mawley, Ed., F.M.S., F.R.H.S.
Moulder, Victor J., F.R.H.S.
Newstead, R., A.L.S., F.E.S., F.R.H.S.
Paul, Geo., J.P., V.M.H., F.R.H.S.
Percival, Professor John, M.A., F.L.S., F.R.H.S.
Rendle, A. B., M.A., D.Sc., F.L.S., F.R.H.S.
Reuthe, G., F.R.H.S.
Saunders, Geo. S., F.L.S., F.E.S., F.R.H.S.
Scott-Elliot, G. F., M.A., B.Sc., F.L.S., F.R.H.S., F.R.G.S.
Shea, Charles E., F.R.H.S.
Smith, William G., B.Sc., Ph.D., F.R.H.S.
Sutton, A. W., V.M.H., F.L.S., F.R.H.S.
Veitch, Harry J., F.L.S., F.Z.S., F.R.H.S.
Ward, Professor Marshall, Sc.D., F.R.S., F.R.H.S.
Wilks, Rev. W., M.A., F.R.H.S.
Worsdell, W. C., F.R.H.S.

JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales de la Soc. Nantaise	Ann. Soc. Nant.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Hort. de Loiret	Bull. Soc. Hort. Loiret.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletin of Bot. Dep. Trinidad	Bull. Bot. Dep. Trin.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt fur Bacteriologie	Cent. f. Bact.
Chronique Orchidéenne	Chron. Orch.
Comptes Rendus	Comp. Rend.
Department of Agriculture, Victoria	Dep. Agr. Vict.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Dictionnaire Iconographique des Orchidées	Dict. Icon. Orch.
Die Gartenwelt	Die Gart.
Engler's Botanische Jahrbucher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Hamburger Garten- und Blumenzeitung	Hamb. Gart. Blum.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal Dep. Agricult. Victoria	Jour. Dep. Agr. Vict.
Journal Imperial Department Agriculture, West Indies	Jour. Imp. Dep. Agr. W.I.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R.A.S.
Journal S.E. Agricultural College, Wye	Jour. S.E. Agr. Coll.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundheitsamte	Kais. Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Notizblatt des Königl. Bot. Gart. und Museums zu Berlin	Not. König. Bot. Berlin.
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Queensland Agricultural Journal	Qu. Agr. Journ.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.

Journals, &c.	Abbreviated title.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gén. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions Bot. Soc. Edinburgh	Trans. Bot. Soc. Edin.
Transactions of the British Mycological Soc.	Trans. Brit. Myc. Soc.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.*
U.S.A. Experimental Station Reports	U.S.A. Exp. Stn.†
U.S.A. Horticultural Societies' publications	U.S.A. Hort. Soc.†
U.S.A. State Boards of Agriculture and Horticulture	U.S.A. St. Bd.†
Wiener Illustrirte Garten-Zeitung	Wien. Ill. Gart.-Zeit.
Woburn Experiment Farm Report	Woburn.
Zeitschrift fur Pflanzenkrankheiten	Zeit. f. Pflanz.

* The divisions in which the U.S.A. Government publish Bulletins will be added when necessary.
† The name of the Station or State will in each case be added in full or in its abbreviated form.

NOTES ON RECENT RESEARCH.

(*See also pages* 186 *and* 498.)

Alpine Plants.

Alpine Plants, Dissemination of. By Paul Vogler (*Flora*, vol. lxxxix. 1901, pp. 1-137 ; 1 cut ; pl. i.-iv.).—This memoir deals with the methods of dissemination of Alpine plants in the Alps from every point of view. It contains (1) a systematic review of the characters of seed and fruit, order by order, and species by species ; (2) a review of methods of transport in the same order and with the same detail ; (3) a "general part," with statistical tables, an analysis of the function of various transporting agencies, reviewing the possibilities of each (such as the strength and direction of the wind in various districts and at different times of the year), the transporting powers of the wind as witnessed by the presence of leaves, salt crystals, &c. Historical data as to immigration are obtained from the visits of successive collectors. Thirty-five pages of tables and seven of bibliography close the study. The author concludes that wind-transport is far more active than animal-transport, and water-transport is absent. This wind-transport, possible over distances up to hundreds of kilometres, is only *efficacious* for distances of 3 40 kilometres. The preponderance of wind-disseminated plants is not due to their special direct adaptation to Alpine conditions, but only to their being favoured in immigration. The special significance of winged seeds and fruits is that thereby the plants gain rapid possession of new stations, especially on steep declivities. —*M. H.*

The Ascent of Water.

Ascent of Water (*Beih. Bot. Cent.* bd. xi. ht. 2, pp. 60-80).—Dr. Kosaroff has studied the transpiration of leafless twigs during the winter. He shows that they transpire water at the usual temperatures, and even at 0° C. both in the laboratory and in the open air. Thus, during winter, there must be a movement of water in the wood-vessels. The amount taken in is not influenced greatly by small variations in the external conditions. The amount of water absorbed is increased by high and diminished by low temperatures, but this effect is not purely physical, for it does not appear in the case of dried-up twigs. Light does not seem to influence the absorption of water in the case of these leafless branches, the amount of water taken in during the day and during the night being about the same. Alcohol, ether, and carbolic acid have an injurious effect; weak solutions of corrosive sublimate have no effect, but strong solutions increase the absorption of water. The living cells play an important part in raising the water of living, though leafless, branches in winter, as is shown by the difference in the behaviour of dry twigs. The paper contains the record of no less than thirty-four experiments (all in tabular form), and must be considered as of extreme importance in all questions dealing with the ascent of water in trees.—*G. F. S.-E.*

CAUSE OF DIRECTION OF BRANCHES.

Branches of Trees and Bushes, On the Causes of the Direction of the. By J. Baranetzky (*Flora*, vol. lxxxix. 1901, pp. 138–239; 20 cuts).—This is a careful study of the habit of trees, as caused by the behaviour of their lateral branches, in which physiological and anatomical data already known are enlarged by new researches, and notably by experiments on weighting and supporting branches, and ascertaining the consequent changes in the tissues developed. A most striking conclusion is that all unilateral growth tends to determine an increased growth on the opposite side. Thus any change of direction produced on the clinostat initiates a series of reciprocating variations of intensity of growth on opposite sides of the stem in the original plane of curvature; as each curve is formed, a counter-stimulus takes place, which finally masters the factor which determined the curve, and consequently diminishes the curve.

The open-air studies comprised the types (1) Bird Cherry, Ash, Maple, Horse-chestnut, Euonymus and 'Syringa' (*Philadelphus coronarius*); (2) Lime and Elm; besides, among Conifers, various Pines, especially the Scotch Pine and the Fir (*Picea excelsa*). The weeping varieties of the Ash, Elm, and *Caragana arborescens* were investigated. For the results the original paper must be consulted. A third section deals very fully with the difference of length of the physiologically upper and under side of shoots, and shows that this affects the individual tissue elements.

M. H.

CELL DIVISION.

Cell Division (*Beih. Bot. Cent.* bd. xi. ht. 2, pp. 134–142, 1 plate).—F. M. Andrews has investigated the karyokinesis in *Magnolia* and *Liriodendron.* The author sums up his results as follows:—

I. *In the First Mitosis.*

(1) The chromosomes arise from the resting nucleus as irregular masses, without a previous formation of the usual and uniform spirem.

(2) That the resulting chromosomes are mostly U-shaped, though many are in the form of open or closed rings, or ellipses.

(3) That they divide here again longitudinally. No longitudinal division of the chromosomes was observed during the meta- or anaphase of the first division. It probably does not occur, since the daughter chromosomes of the first division lose their identity during the reconstruction of the daughter nucleus, and, as these daughter nuclei pass into the resting condition it is extremely difficult to conceive of the purpose of a second longitudinal splitting of the chromatin during the first mitosis.

II. *In the Second Mitosis.*

(1) The identity of the chromosomes, therefore, from the first to the second mitosis is not maintained.

(2) That the chromosomes arise by the segmentation of an irregular spirem, and are at first lumpy bodies.

(3) That the chromosomes arise mostly in the form of shallow U's, but in a few cases rings were formed.—*G. F. S.-E.*

CHLOROPHYLL AND AMIDON IN STEMS.

Chlorophyll and Amidon Formation in Stems. By J. D'Arbaumont (*Ann. Sc. Nat. Bot.* xiii. pp. 319–428; xiv. pp. 125–210; 1901).—Amidon granules, proteid bodies distinguished by brown coloration with iodine, appear just behind the growing point in abundance, soon to disappear except in the endodermis, reappearing in internodes whose growth in length has ceased; after a period of summer increase reaching a maximum in August or September, they decrease in number towards winter, when they disappear, to reappear the following spring in the now one-year-old twig. Two kinds of chlorophyll bodies are distinguished, and their evolution followed throughout the seasons of the first year, till they disappear in winter and reappear next spring. The research has included about sixty species of trees and shrubs. The results are carefully recorded, but the large number of species dealt with favours exceptions, and the absence of summaries is disappointing. The origin of the chloroplasts, amidon, and other bodies dealt with is, however, a fundamental question. The results differ somewhat from those of Sachs, Schimper, or the more recent views of Belzung and Mer.—*W. G. S.*

BOTANICAL CLASSIFICATION.

Classification of the Vegetable Kingdom based on the Egg. By Ph. van Tieghem (*Ann. Sc. Nat. Bot.* xiv. pp. 213–390; 1901). The egg is the starting-point of a new individuality resulting from variations due to the two parent nuclei; the sum of the individualities of the units produces the characters of the race; and the races are the vegetable kingdom. This is the hypothesis; the aim is to found a classification based on it and free from defects of systems in use. Dealing with a subject so wide, the paper is an object-lesson in exposition and brevity, while Van Tieghem's reputation gives it weight. Some of the chief points must suffice here. The first division of plants is into Diodées and Adiodées. The former have the gametes borne on a rudimentary body (prothallus) produced from the adult parent by a diode—a term introduced by Van Tieghem some years ago to indicate what is generally termed the spore. The group of Diodées is, therefore, synonymous with the vascular plants—the Ferns and higher plants. The Adiodées have the egg formed directly on the parent, and include the Algæ, Fungi, and Mosses. The Adiodées are subdivided into Tomiées and Atomiées. In the latter the egg is liberated from the parent, and develops directly into a new individual. In the group Tomiées the egg is not liberated from the parent, but develops into a rudimentary body or "tomiogone," which produces special cells—tomies—and these are liberated and produce plants like the parent. For example, in the mosses the tomiogone is the spore-bearing part, and the tomies are the spores. Van Tieghem advocates the term "tomie" instead of the somewhat vague "spore," and distinguishes them from the diodes which produce a prothallus. Further division of the groups into isogamous and heterogamous and other subdivisions should be followed in the original paper. The result is that while the groups of Mosses and Hepatics remain intact, the Algæ and Fungi are mingled in a startling way, yet one which probably represents the modern

views on classification of these lower plants better than any existing system. Turning now to the other primary group, the Diodées, we find new terms proposed for Vascular Cryptogams on the one hand, and seed-forming plants on the other. The latter, or Endoprothallées, are again subdivided into newly-named groups corresponding generally with Gymnosperms, Monocotyledons, and Dicotyledons. Whether the new nomenclature will ever be adopted as a whole remains in the future, but doubtless the principles of the system will play a part in the making of any new classification. The author, in a criticism, indicates some of its defects, notably the omission of those Fungi, the Bacteria, and the Blue-green Algæ, in which a sexual process is unknown.—*W. G. S.*

Colourless Diatoms.

Diatoms, Colourless. By G. Karsten (*Flora*, vol. lxxxix. 1901, pp. 404–433, pl. x.).—In many species the chromoplast diminishes in size and fades when cultivated in nutritive solutions, even in adequate illumination. The colour and size of the chromoplast are restored when the cells are removed to pure water.—*M. H.*

Epidermis.

Epidermis (*Beih. Bot. Cent.* bd. xi. ht. 4, pp. 219–258; plates 4).—Herr Otto Damm gives a most interesting and instructive account of the perennial epidermal layers found in *Viscum* and other plants. The *Viscoideæ* (Engler's classification) do not form cork except to cover accidental wounds. Instead of cork a "cuticular epithelium" is formed by the external cells of the primary cortex. The epidermis itself persists for a considerable time, and its cells both divide and also stretch sufficiently to keep pace with the growth in thickness. An epidermal cell has been seen with a tangential diameter of 120–130 micromillimetres, whereas at the end of the first year the same diameter is usually 38 μ; the arched outer cell-wall is sometimes 20 μ in thickness. In certain *Menispermaceæ* it was found that cork formation set in sooner or later, but after the above "cuticular epithelium" had developed. In *Acer* and some nineteen other plants it was found that only the epidermis cells themselves produced a covering epithelium, and the primary cortex did not.

The cuticular layers or outer cell-walls of the epidermis are not very elastic, as they break at an elongation of between 2·8 to 5·1 per cent. They possess considerable strength. That of *Aristolochia* broke at a weight of 10·1 kilograms per square millimetre, and an Acacia at 9·2 kilograms. The paper is exceedingly instructive; the work was done in the Botanical Institute, Berlin University.—*G. F. S.-E.*

Biology of Erysipheæ.

Erysipheæ, Researches on the Biology of the. Pt. I. By F. W. Neger (*Flora*, vol. lxxxviii. pp. 333–370; pl. xvi., xvii.).—A study of the modes of dissemination by the outgrowths of the perithecium and their physical properties (hygroscopicity, &c.).—*M. H.*

Anatomy of Grasses.

Grass Anatomy (*Beih. Bot. Cent.* bd. xi. ht. 2; pp. 101–134; two figures).—Dr. Holm (Brookland) has examined the leaf-structure of many species of *Aristida, Stipa, Oryzopsis, Eriocoma, Nassella, Piptochætium, Muhlenbergia, Lycurus, Sporobolus,* &c. He has found that in most species of *Aristida* (and only in this genus) the leaf vascular-bundles are surrounded by a double parenchyma-sheath which contains chlorophyll. Those species which have this structure have no mestome and very little thick-walled mestome parenchyma.—*G. F. S.-E.*

Heterogenesis and Evolution.

Heterogenesis and Evolution. By S. Korschinsky (deceased), Director of the Botanic Gardens of St. Petersburg (*Flora,* vol. lxxxix. 1901, pp. 240–363).—This posthumous paper treats of the phenomenon dealt with mainly in animals by Bateson (who is not cited in the bibliography), under the name of "Discontinuous Generation," and comprises a wide survey of its occurrence in flowering plants. The recorded occurrences of the phenomenon are described in order:—(1) Variations in growth: (*a*) gigantism and nanism, (*b*) in stem and its armament, (*c*) in the habit of the leafy crown of trees; (2) leaf-form; (3) leaf-colour; (4) flower-colour; (5) flower-structure; (6) mode and time of flowering; (7) fruit.

From a study of the records it is probable that any given heterogenetic variation makes its appearance in a single individual only; apparent exceptions are probably due to the variation having occurred unnoted a generation earlier or to hybridism. As a cause of heterogenesis it seems probable that too much weight has been laid by breeders on high cultivation, which may however be efficacious to some extent, for the fact of high cultivation is associated with careful and unwearied search and selection. Variations may be classified as regressive (atavistic), progressive, and indifferent. Heterogenesis is often accompanied by altered physiological qualities, such as diminished reproductive (sexual) powers, weakness of growth, susceptibility to frost. They vary in the constancy of transmission by seed, not only in the original, but also in subsequent selected generations. The immediate cause of heterogenesis probably lies in some alteration of the seed-origin (Anlage during or after fertilisation).—*M. H.*

Leaf Anatomy.

Leaf-anatomy of Australian Podalyrieæ (*Beih. Bot. Cent.* bd. xi. ht. 3, pp. 143–217, plate).—Herr Paul Hühner describes the anatomical characters of *Gastrolobium* (14 species), *Pultenæa* (46 sp.), *Latrobea* (4 sp.), *Eutaxia* (5 sp.), and *Dillwynia* (14 sp.). They appear to show very distinct xerophytic characters. The leaf is generally centric; the nerves are imbedded in sclerenchyma; stomata occur generally on the lower surface; the inner cell-wall membrane of the epidermis cells is often gelatinous. Crystals, sphæro-crystals, and idioblasts are common. The paper is almost an impossible one to abstract, as each leaf in the 83 species investigated has its own individual differences, which are given in detail.—*G. F. S.-E.*

FERTILISATION OF LICHENS.

Lichen Apothecia, The Formation and Development of some. By E. Baur (*Flora*, vol. lxxxviii. 1901, pp. 319–332; pl. xiv., xv.).—This research was intended to seek, by the method of sections, for light on the alleged fertilisation of Lichens. In all cases examined the ascogenous hyphæ were braced to a carpogone bearing a projecting trichogyne, but no fertilisation was observed; this does not exclude the extreme probability of its occurrence, as in *Collema* and the *Laboulbeniaceæ*. The species examined were *Parmelia Acetabulum*, *Anaptychia ciliaris*, *Physcia alba*, *Pertusaria communis*, and *Pyrenula nitida*.

M. H.

RELATION OF LIME AND MAGNESIA TO GROWTH.

Lime and Magnesia: Their Relation to Plant Growth. By Oscar Loew and D. W. May (*U.S. Dep. Agr. Bur. Pl. Ind. Bull.* i. 1901). Two papers are printed in this Bulletin, the first, by O. Loew, dealing with the liming of soils from a physiological standpoint; and the second, by D. W. May, on the experimental study of the relation of lime and magnesia to plant growth.

The presence of an excess of magnesia in a soil renders it practically sterile, and the application of lime made from magnesian limestone in the case of certain soils has been found to be damaging to the growth of crops. The author considers that the bad effects sometimes observed after the addition of kainit and other Stassfurt salts to certain soils are mainly due to the high magnesia content of these artificial manures. These deleterious effects can be mitigated or completely removed by a dressing of lime or other calcium compounds.

Loew draws attention to the analysis of numbers of soils from various parts of the world, in regard to the relative amounts of calcium and magnesium in them, and points out that although the ratio of these two constituents varies between wide limits, in all cases of great fertility of the soil there is never a marked excess of magnesia over lime in them. Usually the amount of lime exceeds that of magnesia considerably.

For the satisfactory nutrition of plants a certain ratio between these two nutrients produces the best results.

Loew considers that magnesia serves largely for the assimilation of phosphoric acid, since magnesium phosphate gives up its acid more readily than any other phosphate met with in plants. When lime is taken up in excess it combines chiefly with the phosphoric acid, and the formation of the necessary amount of magnesium phosphate is prevented. The effect will be the same as if there was a diminution of phosphoric acid in the soil, and starvation may set in.

In water cultures it has been observed that plants grown in solutions of magnesium salts soon become unhealthy, but the injury can be prevented and removed by the addition of calcium compounds. Similar results have been obtained in the field.

The experimental work described by May in the second half of the Bulletin was carried out with the object of determining the effect of vary-

ing amounts of calcium and magnesium salts on the growth of plants, and to study the ameliorating effects of lime salts in overcoming the poisonous results of an excess of magnesia.

The results show that the best proportion of soluble lime to soluble magnesia for the germination and growth of plants is about 7 to 4 actual weight, or 5 to 4 molecular weight.

Sulphate and nitrate of lime were more efficacious in overcoming the noxious effects of magnesia than the less soluble salts of lime.

When the lime in a soil is about equal to or less than the magnesia present, finely powdered sulphate of lime should be applied whenever crude Stassfurt salts, such as kainit and carnallit, are used as manures.

J. P.

THE PEAR-TREE AND MISTLETOE.

Mistletoe, On the Existence of a Substance in the Berries, Seeds, and Embryo of, Poisonous to the Pear. By Emile Laurent (*Comp. Rend.* December 2, 1901).—The germination of Mistletoe seeds on the branches of certain varieties of Pear—'Williams,' 'Joséphine de Malines,' &c.—is followed by the death of these branches during the summer.

The branches of *Spartium junceum* and *Ficus elastica* are also killed by the germinating seeds of Mistletoe.

In the case of the Pear, the bark is killed and contracted to a distance of some inches from the point of inoculation. The vessels are also clogged with a gummy substance, which checks the flow of the sap; consequently the leaves fade and die, followed by the death of the entire branch. In such cases the young Mistletoe never enters the tissues of the Pear, but also perishes. Such varieties of Pear are immune against the attacks of the Mistletoe.

The toxine or poisonous substance is most abundant in the embryo of the Mistletoe seed, and becomes diffused into the pulp of the berry during germination.—*G. M.*

ANATOMY OF SPHAGNUM.

Mosses, Researches on the Anatomy and Biology of. By W. Lorch (*Flora*, vol. lxxxix. 1901, pp. 434–454; 32 cuts).—Contains an account of the formation of the perforations in the walls of the large cells of *Sphagnum*, which give it its peculiar spongy character.—*M. H.*

NATURE OF OZONIUM.

Ozonium auricomum. By Charles B. Plowright, M.D. (*Trans. Brit. Myc. Soc.* 1900–1901).—Producing evidence that the common golden-yellow fibrous substance called *Ozonium*, which has been a puzzle for so many years, and supposed to be the mycelium of some Polypore, is in reality the mycelial condition of *Coprinus domesticus*, a black-spored deliquescent Agaric, which is not uncommon in this country. In this instance the *Ozonium* was developed in an earthen vase in which a pot of *Aspidistra* was growing, and, passing through the mould to the light, produced there the stems and pilei of the *Coprinus*. Another instance is given in which a decayed stick was found with a *Coprinus* on its upper side and a mass of *Ozonium* on the lower.—*M. C. C.*

NODOSITIES ON PEA-ROOTS.

Peas, Beans, and Vetches, Observations on the Formation of Nodosities on the Roots of. By Emile Laurent (*Comp. Rend.* December 23, 1901).—The author observed that the addition of superphosphates to the soil stimulated the production of nodosities on the roots of Peas, Vetches, and more especially Yellow Lupin. This was not the case with the Broad Bean. The nodosities on the roots of this plant were produced by the use of nitrogenous manure, a substance which checked their development in every other leguminous plant experimented with.—*G. M.*

Peas, Influence of Mineral Nutritive Salts on the Production of Nodosities in. By Em. Marchal (*Comp. Rend.* December 9, 1901).—That the vigour of growth of Peas and other leguminous plants depends, to a great extent, on the number of nodosities formed on the roots is a well-known fact. The author has conducted an extensive series of experiments with the various salts commonly used as fertilisers, for the purpose of ascertaining their relative effect on the *Rhizobium*, or organism forming these nodosities.

These experiments have led to the following conclusions:—

Alkaline Nitrates.—Nitrate of potash, nitrate of soda, nitrate of calcium, nitrate of ammonia, used in the proportion of $\frac{1}{10000}$ in water cultures, completely checked the formation of nodosities. The salts of potassium also retard the work of the *Rhizobium* in forming nodosities.

On the other hand, the salts of calcium, sulphate of calcium, and chloride of calcium, also sulphate of magnesium, greatly favour the formation of nodosities.

The influence of phosphoric acid, although varying greatly in its property, depending on the base to which it is united, on the whole, stimulates the development of nodosities.—*G. M.*

PERMEABILITY OF WOOD MEMBRANE TO AIR.

Permeability of the Walls of Tracheæ to Atmospheric Air. By Peter Claussen (*Flora*, vol. lxxxviii. 1901, pp. 422–469; 9 cuts).—Experiments of compression and exhaustion were made on cylindrical pieces of coniferous wood, which, containing only closed tracheids, is alone suitable. The author concludes that woody membranes, like all others, are *more* permeable to gases as they gain in hygroscopic moisture, and indicates fallacies in previous experiments from which Strasburger came to the contrary conclusion. As N. J. C. Müller has discovered that gases diffuse the more readily as they are the more readily absorbed by water, the explanation appears to be that this moisture absorbs and carries the gas from the side of greater pressure and delivers it on that of less pressure. The tension of the gas contained in living wood was estimated at 0·5–0·9 atm.—*M. H.*

PLANT BREEDING.

Plant Breeding. By Prof. Willet Hays, of the University of Minnesota (*U.S.A. Dep. Agr. Div. Bot. Bull.* **29**, **1901**).—A valuable con-

tribution, worthy of careful study both by the practical breeder and the student of variation and heredity. The actual experiments detailed by the author are mainly agricultural, though the general principles deduced are of equal interest and value to horticulture. In view of recent writings, it is decidedly refreshing to read Prof. Hays' opinion in the introduction, that "in European countries much more attention is given to the improvement of plants than in America." And again: "The seedsmen of America have not kept pace with European seed firms in variety formation, nor even in keeping up and improving old forms." But, judging from Prof. Hays' paper, it is possible that the "great system of American experiment stations" more than makes up for these shortcomings.

Examples of Results of Breeding.

As an example of the results obtained by breeding, Prof. Hays mentions that the experiments in Wheat-breeding carried out at the Minnesota Experiment Station for ten years have resulted in the production of a new variety, which produces nearly 25 per cent. increase in yield over the older varieties from which it has been bred, together with other advantages, such as increased power of resisting "rust." The author also quotes the European case of Sugar Beets, in which "the amount of sugar in the juice of the roots has been increased probably 100 per cent. by the rigid scientific methods, first started by Vilmorin in France, and now practised on a large and extensive scale by European seed-growers."

The Value of Large Numbers in Breeding Experiments.

Prof. Hays rightly lays stress on the value of large numbers in breeding experiments, with rigid selection of the best forms only.

In regard to this, a point of great importance is noted, and that is that the best individual does not always produce the best progeny: not that the worse produce better, but that a few only of the "best" will produce improved offspring, owing to the constant tendency to regress towards the average of the ancestry. Much testing has, therefore, to be done in order to ascertain which of the "best" are really the "best" for continuing and improving the breed. This fact has also been noted in animals: the best performers are not always the best at the stud. What is required, therefore, is a careful selection of the selected for breeding purposes.

General Facts concerning Heredity.

Prof. Hays sums up the following principles to be observed in improving plants:—

"(1) The individual plant produced from a seed is the important unit in plant breeding. The 'bud unit,' though of much consequence in case of marked bud variation, is usually of minor importance.

"(2) Heredity, centripetal-like, enables us to produce from certain choice plants many descendants which on the average, quite resemble their parents.

"(3) Variation, centrifugal-like, causes the production among the descendants, along with very many average plants, of a few very good individuals, and a few very poor ones.

"(4) By selecting those best plants which, upon trial, produce superior progeny, the whole variety may be slightly or considerably improved.

"(5) Since the plants of each succeeding generation also vary, by repeatedly choosing the best the variety or race is further improved.

"(6) In many cases crossing increases the average vigour of the progeny, but in other cases it decreases the average vigour, size, or other desirable characteristics.

"(7) In all cases crossing increases variation, as a rule, both toward better plants and toward poorer ones, thus giving opportunity for selecting from among the best plants individuals which are superior, as progenitors of varieties, to any individuals which could have been secured without crossing.

"(8) New varieties can best be founded upon one to a dozen superior selected or cross-bred seedling plants used as parents.

"(9) Very large numbers of individuals must be used from which to select or breed, in order that mother plants may certainly be discovered from which superior varieties will spring."

The Use of Variation Illustrated.

Prof. Hays introduces some interesting diagrams giving graphic expression to Quetelet's law of variation. Two strains of pure-bred Wheats are shown, the individuals of which diverge very little from the average, except a few at both extremes, which are either very good or very poor, and it is only from a few of the extreme good ones that future progress can be made. These two strains are then crossed together, and the result is very striking.

There are still large numbers which retain the average value, but at the two extremes the good and poor forms are more numerous and more extreme than in the case of either of the two pure-bred strains. These graphic diagrams show at a glance the powerful value of cross-breeding in securing variation (both good and bad) quickly, *e.g.* to take a single character of the above, *i.e.* "yield in grams per plant."

(1) The pure-bred "Fife" Wheat individuals varied in yield from $\frac{1}{2}$ to 5 grams.

(2) The pure-bred "Blue Stem" Wheat individuals varied in yield from 1 to $5\frac{1}{2}$ grams; while

(3) The "hybrid" race, between the two, produced individuals which varied in yield from 0 to $11\frac{1}{2}$ grams.

Further breeding from those individuals giving the greatest yield shows that the maximum yield is by no means maintained, though the average yield is gradually and surely increased.

Curiously enough, some plants, which individually yielded well, produced progeny decidedly low in yielding power, thus demonstrating that the "force of heredity of the family, race, and species powerfully combats the new characteristics and tends to reduce the new forms to conformity with the old. Thus, in trying to raise the yield above the average, we must eliminate not only the poor but the average blood, retaining only the blood of the few which have the greatest ability to produce progeny with exceptionally large yield."

From these experiments follow two important facts:—"(1) That we

can improve Wheat by selecting the best from our standard Wheats. (2) That still more can be accomplished if we create new qualities by hybridising, and then seek, from among very many, those few plants that will best perpetuate the desired quality."

"The real value of variation lies in the ability of the plant to produce plants which individually and in the aggregate yield more and better grain than the average of the same variety. The yield of the mother plant is a very uncertain indication of its use for the mother of a new strain, just as 'Messenger's' record as a trotting horse is no index to his great value as the progenitor of the American breed of trotting horses."

Breeding by Hybridisation and Selection.

"Most of the variation in plants has its origin in reproduction from seed, the variation being, as a rule, the greater the more distant the relationship between the two parents.

"In breeding by selection alone the variations occurring naturally or accidentally within the variety are depended upon.

"In breed or variety-formation through the agency of hybridisation, followed by selection, man plays almost a creative part. Where there is no variation of such nature as desired, it is created by bringing together two of the many forms which have varied from some ancestral form, yet not so far but that they will cross-fecundate. The further they have departed from ancestral characteristics and formed diverse qualities, the more likely will their progeny exhibit new characteristics made up of combining those which have become so radically different in the two parents."

Degree of Relationship in Crosses.

With regard to the question of the alleged evils of very close breeding – "in-and-in"—Prof. Hays maintains that even such close-fertilised species as Wheat may be materially improved by "the most incestuous kind of inbreeding, carried on for many generations." Probably in this case Prof. Hays was careful to select only the most healthy and most fertile plants as parents. With regard to the increased vigour, size, and value obtained by cross-breeding, Prof. Hays gives an apparent exception to the rule.

Certain Wheat "hybrids" at the Minnesota Station after a few generations "became very weak, and finally ceased to produce seeds, while other stocks from the same two individual parent plants were very strong, and were the progenitors of some of our most promising new Wheats." This suggests that both vigour and fertility are themselves subject to variation like other characters.

Hybrids and Crosses defined.

Prof. Hays follows the lead of Messrs. Swingle and Webber when he defines the term "hybrid" to mean "a plant resulting from cross-fertilising plants differing in their relationships, whether that difference is great, as in species or even genera, or comparatively slight, as in distinct varieties."

This is not the definition usually employed in Europe, where the term "hybrid" is generally confined to the product of distinct species and

genera. As a result of Darwin's great work, the term "species" has naturally become somewhat less definite as a unit, but it is a convenient term nevertheless, and it remains to be seen whether the American definition of "hybrid" will come into general use.

Breeding for Special and New Uses.

Prof. Hays throws out some interesting suggestions for future hybridists and breeders—*e.g.* the breeding of increased nitrogen compounds into field crops, so as to make them more valuable as food. He also refers to Mr. Swingle's suggestion that the nitrogen-gathering bacteria associated with the nodules on clover roots could be bred so as to be more actively useful, in the same way that brewers have successfully bred special varieties of the yeast plant for making beers of different qualities.

Prof. Hays says:—"There is no reason why the nitrogen content of a variety cannot be increased as well as the sugar content, flavour, hardiness, height, or any other measurable characteristic."

Prof. Hays proceeds to give some practical illustrations of the methods of plant breeding at the Minnesota Station, those on the manipulation and pollination of wheat flowers being most interesting. Prior to crossing, the Wheat florets have of course to be emasculated, generally from one to two days before the flowers open; when the flowers open, the foreign pollen has to be introduced within the space of a few minutes, as they are soon over, showing the necessity of careful observation and manipulation.

Prof. Hays gives an interesting photograph (p. 56, pl. vi., fig. 1), showing how "hybridising" Wheats causes variation. Two pure-bred varieties of Wheat, *i.e.* 'Fife' and 'Blue Stem,' are crossed and produce a rather inferior-looking ear unlike either of the parents. The progeny of this in the second generation, self-fertilised, produced, out of 100 plants, thirteen totally distinct Wheats, including bearded and awnless, long and short, loose and compact ears, and, what is really more remarkable, several of them are much like the different so-called "species" of Wheat. Whether this is proof that all the domesticated Wheats originated from a single species, or whether they have been produced by hybridisation from several species, is difficult to say. One thing is clear, however, and that is that there is a blood relationship between the different classes of Wheat. As Prof. Hays says, "It is a remarkable illustration of the intricate relationships existing in nature even among plants apparently exclusively self-fertilised." Prof. Hays gives a good illustration of how quickly a variety can be fixed after "hybridisation."

"In 1893, from a floret of 'Blue Stem' Wheat pollinated from a 'Fife plant, there resulted a seed which in 1894 developed into a plant. . . . In 1895 a 'centgener' of plants was grown from the 1894 mother plant. Of these 30 per cent. had smooth chaff, resembling the 'Fife' parent, and 70 per cent. had hairy, velvety chaff, resembling the 'Blue Stem' parent. In the succeeding years smooth-chaffed plants were chosen for mother plants from one stock selected for the development of a smooth-chaffed variety, and plants with velvety chaff were chosen as mother plants from another stock selected for the development of a hairy-chaffed variety. . . .

In the third generation each was nearly true to type, and it remained nearly true to type."

Finally, Prof. Hays gives further interesting details of the methods of improvement by breeding and selection of "Corn" (*Maize*), Timothy (*Phleum*), Potatos, Apples, Walnuts, and Flax, the special details of which are perhaps more suitable for America than Europe, though the general principles followed are the same for all, as quoted above in regard to Wheat.

This brings us to the end of a most valuable paper consisting of seventy-two well-printed pages, with six excellent photograph plates, and twenty-one text figures and diagrams. This paper once more illustrates the practical genius of the American people, who, possessing a full knowledge of modern scientific researches and theories, and careful recorders and experimenters themselves, yet concentrate their whole energies on practical results.—*C. C. H.*

Leaf Points.

"Precursor Point," The, in some Monocotyledons. By K. Goebel (*Flora*, lxxxviii. 1901, pp. 470-2; 2 cuts).—The leaf of several Endogens, such as *Doryanthes Palmeri*, ends in a conical point, circular or triangular in section above, but opening out below into the flat leaf-blade, and withering when the leaf expands. It is rich in intercellular spaces and bears stomata. It serves to close the apex of the bud, while helping respiration. The organ occurs in the common 'Arum Lily' (*Richardia africana*, syn. *Zantedeschia æthiopica*, *Calla æthiopica*).—*M. H.*

Corn-rust.

Rust of Corn ("Beiträge zur Kenntniss der Grasroste"). Fritz Muller, aus Kreuzburg in Schlesien (*Beih. Bot. Cent.* bd. x. ht. 4, 5, pp. 181-212, 2 figs.).—The paper contains records of an enormous number of infection experiments carried out with *Puccinia dispersa* and *P. graminis*. The most important results are as follows:—

Puccinia dispersa, Eriksson, shows three special forms:

(*a*) Special form Secalis with æcidia on *Anchusa officinalis* and *A. arvensis*. Teleutospores on *Secale*.

(*b*) P. Symphyti-Bromorum with æcidia on *Symphytum officinale* and *Pulmonaria montana*. Teleutospores on *Bromus* spp. (perhaps sp. form Bromi of Eriksson).

(*c*) P. dispersa. Æcidia unknown.

Of *Puccinia graminis* the author records both the special forms Agrostidis and Avenæ of Eriksson and nine other special races found respectively on *Triticum glaucum*, *T. caninum*, *Secale cereale*, *Poa nemoralis*, *Festuca pratensis*, *Apera Spica-venti*, *Lasiagrostis Calamagrostis*, *Festuca ovina*, and *Agrostis alba*.

By numerous experiments each of these special forms was found to be unable to attack a whole series of other Grasses. There are also numerous tables, and full details of the experiments.—*G. F. S.-E.*

The Development of Seeds.

Seeds, Researches on the Development of. By Frederick H. Billings (*Flora*, vol. lxxxviii. 1901, pp. 253-318; 101 cuts).—The author

has studied the development from fertilisation to maturity in *Oxalidaceæ*, *Linaceæ*, *Geraniaceæ*, *Stackhousiaceæ*, and fourteen corollifloral orders, by modern methods of microscopy. The observations are detailed and interesting. In *Calendula* one synergid divides in two cells which enlarge and pave the way for the upgrowth of the endosperm into a haustorium or feeding outgrowth of the endosperm cavity into the nucellus at the micropyle. Micropylar haustoria are, however, when present, usually developed from the endosperm, as are chalazal haustoria. In *Geraniaceæ* the haustorium is an enlargement of the suspensor in the short arm of the J-shaped embryo-sac. The differences between allied genera may in some cases be greater than those of distinct orders in others; so that systematic value cannot be attached to them. The Gruinales show remarkable divergence in development.—*M. H.*

RED MOULD ON SNOW.

Snow-Mould. By Paul Sorauer (*Zeit. f. Pflanz.* xi. pp. 217 228; 11/1901).—Snow-mould and red snow have long found a place in the books of popular science as examples of vitality of plant life. In 1843 Unger examined snow-mould, ascribing it to a fungus, *Lanosa nivalis*. Apart from its interest as a snow organism there is an economic question, whether it causes damage to grasses and autumn-sown cereals. Sorauer, induced by recent complaints, re-examines the mould. He finds that its greatest development is in time of thaw, the place most favourable being under low-lying patches of snow in the cavity formed in thaw between the snow and the soil; and that snow-crushed or frost-killed vegetation is preferred as a substratum. The mould forms patches like felted gossamer, and produces reddish spores of the *Fusarium* type, also resting chlamydospores as beads on the filaments. The general dampness prevailing in thaw favours its growth, but a low temperature is not necessary, because when transferred indoors it grows rapidly. Infections demonstrated that young seedlings of Rye were attacked, whereas old, well-rooted plants were not. The injury of cereals and grasses by frost and snow and the partial blanching of plants long buried under snow render them favourable to attack. The research throws light on the well-known bleached appearance and slow recovery of vegetation which has been long covered with snow. As the snow disappears and the soil dries, the fungus disappears, but before doing so resting spores are abundantly produced. The mould is suspected to have some summer form of growth unrecognised as yet.—*W. G. S.*

FORMATION OF SPORES.

Spore Formation in Saccharomyces. By B. T. P. BARKER, M.A. (*Trans. Brit. Myc. Soc.* 1900–1901).—This communication, which is too technical and abstruse to be appreciated by the general reader, gives the results of experiments made on spore formation in the yeast fungus.

M. C. C.

GERMINATION OF SPORES.

Spore Germination. By N. Schulz (*Beih. Bot. Cent.* bd. xi. ht. 2, pp. 81–97, with 8 figures).—Moss and Fern spores germinate only in the

light; the Waterferns, *Ceratopteris* and *Ophioglossaceæ*, being, however, exceptional in this respect. Light appears to be necessary for the assimilation and digestion of the reserve material. An apparent germination of Moss spores occurs in a strong sugar solution, which is apparently not comparable with a true germination.—*G. F. S.-E.*

TACTILE STIMULATION.

Tactile Stimulation Phenomena, Observations and Considerations on. By W. Rothert (*Flora*, vol. lxxxviii. pp. 371–421).—This deals with protoplasmic physiology as shown in mobile Protophytes and Protozoa.—*M. H.*

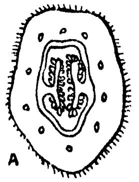
GRAFT VARIATION.

Vine, A New Case of Variation following Mixed Grafting in the. By A. Jurie (*Comp. Rend.* December 23, 1901).—As a result of mixed grafting, a vine produced hermaphrodite flowers, whereas the stock had previously only produced male flowers. This was attributed to a mixture of the sap of the stock and graft, which produced a common sap of the required nature, which had been previously lacking in both members. This discovery led to other experiments in mixed grafting, with the object of producing phylloxera-resistent varieties, which should at the same time produce early and good fruit.

One variety of Vine used for the experiment was very susceptible to the phylloxera. Its fruit was late in forming, foxy, and produced many seeds. Examples of this plant were grafted on stocks that produced fruit early and were strongly resistent to phylloxera. The following year these plants produced beautiful fruit without a trace of foxy taste, ripe on August 15, whereas the fruit of the grafted variety were still young. All the examples grafted showed the same line of variation indicated.

Other experiments, with plants specially susceptible to chlorosis and phylloxera respectively, proved that grafting on stocks known to be specially resistent to these diseases resulted in the immunity of the plants, considered by the author to be due to the production of a common sap furnished respectively by stock and scion.

The author concludes as follows:—The specific variation observed by M. Daniel, produced by grafting, in herbaceous and certain woody plants, exists also in the grafting of the Vine, which is contrary to the general opinion. This variation bears on sexuality, precocity, and resistance to external agents, and can be augmented or diminished according to the predominance of this or that series, and results from the coalescence of vegetative cells. This realisation of experiments opens up a new field which will doubtless render the greatest service to viticulture.—*G. M.*



ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

(*See also pages* 199 *and* 525.)

Acriopsis sumatrana (*Chron. Orch.* p. 314; 3/1901).—A new species from the Malay Archipelago, described by M. R. Schlechter in *Oesterreichische botanische Zeitschrift*, 1900, Nos. 7 and 9. The same author monographs four other species of this Malayan genus.—*C. C. H.*

Aerides Vandarum, Rchb. f. (Cogniaux in *Dict. Icon. Orch.*, *Aerides*, pl. 4; 9/1901).—A rare and curious species with cylindrical leaves, from the Himalayas. Flowers pure white.—*C. C. H.*

Alfalfa as a Fertiliser (*U.S.A. Dep. Agr. Bull.* 133, *Exp. Stn. Work*, xviii. 1901).—This leguminous plant is known as a valuable feeding stuff for poultry, pigs, and all kinds of stock, but it is also a good fertiliser, especially for arid soils, improving the tilth, increasing nitrogen, and destroying weeds by crowding them out.—*C. H. C.*

Agathosma stricta. By A. H. Wolley Dod (*Journ. Bot.* 468, pp. 398 9; 12/1901).—Description of new species from Constantiaberg, Cape Colony.—*G. S. B.*

Agrostology in U.S.A. By Cornelius L. Shear (*U.S.A. Dep. Agr. Div. Agrost. Bull.* 25).—A review and summary of the field-work done since the organisation of the Division of Agrostology which was established by Congress in 1895. Progressive farmers, stockmen, and dairymen had for some time recognised that there was urgent need of a thorough study of the various forage problems which were presenting themselves in different parts of the country. The rapidly deteriorating condition of the native meadows and ranches of the great West naturally led the stockmen to inquire into the reasons for these conditions, and to try to ascertain what steps might be taken to improve them. Of the unoccupied public lands, about 365,400,000 acres are regarded at the present as fit only for grazing purposes. There are in addition 124,300,000 acres of forest land, the greater portion of which is also used for grazing. The relation of the grazing industry to forest reserves, to the water supply, &c., cannot be solved except by long and careful investigation of the actual facts and conditions prevailing. The questions involved required first of all a thorough and accurate knowledge of the actual facts and conditions existing. Thus field-work was commenced as soon as the Division was established, in order that the necessary data might be secured as a basis for future work and recommendations. The pamphlet therefore deals with the persons engaged in the work, and the territories covered by each; the principal problems and requirements at the beginning of the work; review of the field-work by regions; general survey and summary;

control of grazing lands. There are no fewer than 308 grasses and forage plants referred to in the pamphlet, and it is illustrated with fifty-two illustrations, all photographs, and eight maps.—*A. W. S.*

Alpine House at Kew, The. By W. Irving (*Garden*, No. 1,580, p. 136; 1/3/1902).—An account (illustrated) of this most interesting house in early spring. A full list is given of the plants that are grown there, all in pots, and to those interested in early flowering hardy plants should prove most helpful.—*E. T. C.*

Androsace, The Acclimatisation and Culture of. By M. G. Magne (*Jour. Soc. Nat. Hort. Fr.*, p. 947).—The writer complains of the wholesale collection of clumps of these Alpine rarities for table decoration by the hotelkeepers of some of the higher altitudes.

A synopsis of the Alpine and Pyrenean species, as well as of the Himalayan kinds, is given, and some details of their culture in the writer's garden at Boulogne.

His culture seems much like that adopted in England. Soil, peat mixed with stones and sand; frequent summer waterings to keep the peat moist; and protection from the winter rains, here their worst enemy. The notes as to varieties requiring partial shade or full exposure to sun may be useful.—*G. P.*

Anemone japonica. By X. (*Bull. R. Soc. Tosc. Ort.* 9, p. 285; Sept. 1901). Enumeration and description of the various varieties of this plant.—*W. C. W.*

Angræcum stylosum, Rolfe (Cogniaux in *Dict. Icon. Orch. Angræcum*, pl. 6; 9/1901).—A curious little species from Madagascar, introduced by Messrs. Sander, St. Albans, in 1893. Flowers pure white, pendent.—*C. C. H.*

Annuals, Autumn Sowing of. By G. Courtois (*Rev. Hort.* pp. 410-411; September 1901).—Suggestions for sowing numerous annuals in September for spring planting.—*C. T. D.*

Ansellia confusa, N. E. Brown (Cogniaux in *Dict. Icon. Orch.*, *Ansellia*, pl. 2; 9/1901).—A West African species often confounded with *A. africana*. Flowers yellow, with transverse bars of chocolate brown; front lobe of lip pure yellow.—*C. C. H.*

Ansellia gigantea, Rchb. f. (Cogniaux in *Dict. Icon. Orch.*, *Ansellia*, pl. 1; 9/1901).—A native of Natal, discovered in 1841. Flowers yellow, spotted with reddish-brown.—*C. C. H.*

Anthurium Andreanum rhodochlorum. By Ed. André (*Rev. Hort.* pp. 452-3, October 1901; coloured plate).—Raised by MM. Chantrier frères. Curious form, very robust, spathe broadly deltoid, pointed half rosy, merging into green in the lobes. Spadix at first pale yellow, then white.—*C. T. D.*

Apple Districts of West Virginia. By L. C. Corbett (*U.S.A. Exp. Stn. W. Virg. Bull.* 75, April 1901, with cuts).—Showing the area

of Apple culture in the State, with tables of the relative value of varieties. Also further tables for the different counties, with the varieties cultivated, their merits, and the effects of blight and scab amongst them. The varieties classed as Table Fruits, Market Fruits, and Long Keepers.

M. C. C.

Apple in West Virginia, The. By L. P. Miller (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 and 1900, p. 339).—The writer describes the progress of Apple-growing in this State, and concludes with some interesting suggestions as to dealing with San José scale, woolly aphis, &c.—*V. J. M.*

Apple-root Knot. By C. C. Bell (*U.S.A. Hort. Soc. Missouri* 1900).—The trees had root-galls or knots at the point of union of scion and root, about as large as hickory nuts, yet the trees in the nursery look all right. One hundred per cent. of the trees of the variety Lady Apple have these knots. Prof. Toumey says they are caused by a slime mould in the soil. It occurs upon seedling as well as grafted trees. Another authority says that the tree begins to die when the knot chokes it. Some trees live for several years with the galls upon them.

M. C. C.

Apple-root Rot. By E. M. Willcox (*U.S.A. Exp. Stn. Oklahoma,* October 1900).—Doing a great deal of damage to some orchards. It first attacks the small roots, and then spreads to the larger roots and trunk. In about two years the entire root system of the tree is killed. In the thick bark around the base of the trunk layers of a white velvety substance (*mycelium*) can be seen between the layers of the bark. Reported that an Agaric is the cause of this disease; the stems grow in clusters from the base of the trunk, about two inches high, with a cap, like an inverted thimble, half to one inch in diameter. The fungus is said to be edible, but is not determined, nor is sufficient information given for its identification. This disease is confined to orchards that were set out on land formerly covered with timber. It is found also in Missouri, Texas, California, and Tennessee.—*M. C. C.*

Apple Sawfly (*Hoplocampa testudinea,* Cam.). Anon. (*Jour. Bd. Agr.* vol. viii. No. 2, pp. 183–187, with illustrations).—An account of the nature of the infestation, and also of the life-history, is given. The method of prevention and treatment is given thus: "Little can be done in this attack when the pests have once taken up their abode in the fruitlets, but, as we know they migrate from one Apple to another, it is certainly worth while in young plantations to pick off the diseased fruitlets and destroy them. Spraying would do little good, although it would, of course, if arsenites were used, prevent the grubs from entering fresh fruits; but hand-picking is far preferable when the trees are small. The only other thing to be done is to destroy the larvæ in the winter when they are buried in the cocoons under the soil. These may be got rid of by well working the soil, beneath the trees that have been invaded, with a prong hoe, and then dressing the ground with gas lime or kainit. Better still would be to remove three inches of the soil just round the trees, and

burn it during the winter. Unless this is done, or the apples that are invaded are collected and burnt with the grubs in them, the attack will continue from year to year in the same orchard." It is further suggested that poultry might destroy these insects.—*R. N.*

Apple Scab (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 *and* 1900, p. 279, 2 figs.).—A note on this fungous foe of the modern orchardist (*Fusicladium dendriticum*), describing its effect on fruit and leaf, and suggesting mode for its treatment.—*V. J. M.*

Apples, New Disease in. By L. Mangin (*Rev. Hort.* pp. 474-5; October 1901).—*Diplodia pseudo-diplodia*, a fungus which attacks the bark and wood. Description of damage caused, and suggested remedies. *C. T. D.*

Apples of the 'Fameuse' Type (*U.S.A. St. Pomological Soc. Maine*, 1900, with plates).—Descriptions of the fruits, history, and figures occupy the chief place in this part of the Transactions.—*M. C. C.*

Apple Trees, The Root-killing of. By Prof. N. E. Hansen (*U.S.A. Hort. Soc. Iowa, Ann. Rep. for* 1899, p. 417).—An instructive paper in which the writer gives his experiences and views, and refers to his investigations in Russia, &c. The *Pyrus baccata* is most frequently referred to. Some valuable suggestions are made, but it seems to be admitted that the causes of root-killing must yet be settled by experiments.—*V. J. M.*

Artificial Crossing, Results of (*Rev. Hort.* p. 121; September 1902, quoting *Rev. Hort. Belge et étrangère.* M. Jules Burvenich).—M. Burvenich points out that it is a mistake for hybridists who cross marked forms and obtain a majority of offspring in which the parental types are not combined, to throw these away and only cultivate the obvious successes. The seeds of these presumed failures are capable of yielding very diverse combinations of the original parental features, including the parental forms aimed at, which are thus acquired in the second generation in lieu of the first.

In this connection there will be seen a confirmation of the Mendelian law, in the exposition of which Mendel distinctly indicates the probability of such results if the first offspring be sown from.—*C. T. D.*

Artificial Manures, Report of the Commission on. Result of special researches by the secretary of the Commission, M. Georges Truffaut (*Jour. Soc. Nat. Hort. Fr.* p. 919).—The series of experiments were undertaken to demonstrate the value of supplementary manures associated with animal manures, and that beneficial profit was derived from their employment.

A series of experiments were made to illustrate the accuracy of the analytical method of plant feeding.

Detailed tables and results, with photographs, are given of the culture of Gypsophila and of Petunias, which, treated with manures based on the analysis of these plants, exhibited most successful results.

Secondary experiments were undertaken with the Gypsophilas to

ascertain the best and most effective form in which to give the necessary phosphoric acid. These show conclusively the superiority of (1) ammonia phosphate and (2) of phosphate of potash to superphosphates.

Further interesting details observed are the modification of the relative proportion of flowers and of other portions of the plant from the omission of individual constituents from the mixtures.

Plants were found to apparently seek food from the clay of the pots (taking away sufficient to affect the weight) to supply deficiencies in the soil.

Petunias were noticeable for the large amount of potash in their constituent elements.—*G. P.*

Asparagus Rust, Spraying Experiments with. By F. A. Sirrine (*U.S.A. Exp. Stn. New York, Bull.* 188; December 1901; 12 illustrations).—Gives an account of experiments with resin-Bordeaux mixture used as a remedy against Asparagus rust. A gain of over 44 per cent. in the yield is reported. A recipe for the making of the resin-Bordeaux is given, and the details of construction of a large power-sprayer are illustrated.—*F. J. C.*

Auricula, Introduction of the Florist's. By Rev. F. D. Horner (*Garden*, No. 1,573, p. 20; 11/1/1902).—Extracts from the records of the Spalding Gentlemen's Society concerning the early history of the Florist's Auricula. There are several illustrations, and evidence brought forward to show that Lancashire was an early English home of this flower.—*E. T. C.*

Bamboo Garden at Kew, The. By W. Dallimore (*Garden*, No. 1,576, p. 78; 1/2/1902).—This garden, one of the most interesting features of the Royal Gardens, is described fully. One learns when and how it was made, and a most useful list of the Bamboos and other plants made use of in its planting is given. There are three illustrations showing the beautiful winter aspect of the Bamboos.—*E. T. C.*

Bananas and Plantains. By J. Masters Hillier (*Gard. Mag.* 2,510, p. 795, 7/12/1901).—In this article the species producing the edible Bananas and Plantains are named, and the countries in which they are grown for export to British markets; also the modes of packing and a tabulated list of countries to which the fruit is exported from Jamaica, together with quantities and estimated value.—*W. G.*

Bananas—The Jamaica trade. By D. Morris (*Gard. Chron.* No. 767, p. 180; September 7, 1901).—A short account is given of the various kinds of Bananas in cultivation, not only in the West Indies but elsewhere. The author is the Commissioner of Agriculture for the West Indies.—*G. S. S.*

Bees and Bordeaux Mixture. By E. Jacky (*Zeit. f. Pflanz.* xi. pp. 212–214; 11/1901).—It has been suggested that Bordeaux mixture, to which sugar or syrup has been added to increase its adhesion, attracts bees and kills them. Experiments were instituted to test this. The

results are that bees were not seen to visit plants treated with sugared Bordeaux mixture, nor was there an excessive mortality during experiments extending through seasons 1900 and 1901.—*W. G. S.*

Begonia 'Gloire de Lorraine,' Multiplication of (*Bull. R. Soc. Tosc. Ort.* 11, p. 350; November 1901).—Hitherto it has been propagated by cuttings taken from small branches formed at the base. Adolph Van den Heede recommends another method—viz. that adopted with *Begonia Rex.* Towards the end of the flowering season the half-mature leaves are cut off and planted in sandy soil. In 15-20 days, without being protected, but at a temperature of 15°-20°, the leaves put forth roots, and buds begin to appear at the base of the stalk. They are then potted and grown in a good warm covered stove, taking care to place the plants as near the glass as possible. These cuttings produce in the same year fine plants which will bloom all the winter.—*W. C. W.*

Begonia Vernon (*Bol. R. Soc. Nac. Hort.*, November 1901).—This plant, described as an interesting novelty in possessing uniformly purple leaves, is placed on the market by a gardener named Erfurt. It is a derivative of *Begonia semperflorens.*—*G. M.*

Begonia versaillensis. By — Brunet (*Bull. Soc. Hort. Loiret*, tome vi. No. 18, p. 575; 1901).—Recommends multiplication by potting up old crowns, and using the second crop of shoots produced, as cuttings, instead of by seed.—*E. A. B.*

Begonias, Tuberous, Propagation of (*Rev. Hort.* p. 467; October 1901).—Tubers to be cut up after roots emitted and top growth well advanced and in active growth. No loss thus incurred, as is suffered by cutting up dormant tubers, growth not being checked at all by the operation.—*C. T. D.*

Birds, To keep off from Fruit (*Agr. Journ. Cape G. H.* vol. xix. No. 8, p. 567).—"I learned a trick while in the Philippines in the matter of keeping birds out of fruit trees," volunteered a well-known official of the Department to a *Washington Star* reporter, "which may be of value to many just now, when so many Cherries are being destroyed by birds. It is simple, inexpensive, and, as far as I could observe, practical. It consists in hanging a small mirror on the top limbs of the tree. There should be at least six inches of string to the mirror, so that it can swing about as it is blown by the wind. The flash of the mirror, it appears, scares the birds away. One or two five-cent mirrors hung on a tree is sufficient, though, of course, three or four would be much better. I was told that this method had worked in the Philippines successfully for many years, and that the birds do not grow familiar with it as they do with a scarecrow. Since my return here I find that the mirror scare is not unknown here, and that it has been in use by Michigan fruit-growers for many years. I have tried it myself in a small way, and it is amusing what a stir it creates among the birds."—*Texas Stock Journal.*

R. N.

Blackberry Culture. By H. D. (*Jour. Hort.* p. 332; October 10).—Instructions are given, and its more general use advised.

C. W. D.

Black Currant Mite (*Woburn 2nd Rep.* 1900, p. 7).—Experiments on removing buds, cutting down and removing bushes, showing the liability to attack of different varieties. Spraying with various strengths of carbolic acid, calcium sulphide, petroleum, antinonnin, none of which spraying is recommended. Painting with turpentine, methylated spirits, naphtha, solution of naphthaline in naphtha form, aldehyde, petroleum emulsions; treatment with hot water, at different temperatures for different lengths of time. The difficulty is to kill mites and eggs, without injuring the plant. It is considered that cutting down the bush to ground-line and removing roots to unaffected surroundings gets rid of the mite, when new sprouts are produced.—*C. H. H.*

Bletia hyacinthina, R. Br. (Cogniaux in *Dict. Icon. Orch., Bletia,* pl. 1; 11 1901.) -A native of China, Cochin China, introduced in 1803. Flowers lilac to crimson. - *C. C. H.*

Bouquets, Japanese. By G. B. (*Rev. Hort.* pp. 431 34; September 1901).—Five woodcuts. Illustrating and describing some very quaint treatments of plants and branches for bouquet purposes, or rather indoor decoration in pots and vases. --*C. T. D.*

Brown Rot. 'Sur une epidémie de Rot Brun aux environs de Paris.' By M. Marie Molliard (*Bull. Soc. Myc. Fr.* xvii. p. 280; 1901). - This mould, which is known as *Monilia fructigena* in Britain and North America, chiefly attacks the ripe fruit of Pear, Apple, Cherry, &c.; but in the outbreak here recorded it attacked Apricots principally, and not only fruit but the foliage, twigs, and flowers, producing gummosis in the cicatrices of the fallen leaves, causing great damage. In substantiation of this statement healthy plants were inoculated by the aid of pure cultures of *Monilia fructigena,* which resulted in the production of the disease. It is recommended that in the spring sulphate of copper solutions should be used freely.—*M. C. C.*

Brown Spot of Apple. By Prof. C. O. Townsend (*U.S.A. Hort. Soc. Maryland,* 1900, with cuts).—In the early stages of the disease the surface of the fruit appears perfectly normal, but as the disease advances sunken spots appear scattered irregularly over the surface. When cut the flesh is found to be filled with brown spots, scattered irregularly from core to surface. The spots are variable in size, irregular and indistinct in outline, while their texture is somewhat tough and spongy. These spots are found to be filled with a thread fungus, which is responsible for the spots. The sunken spots of the surface become more marked and darker than the surrounding epidermis. The brown spots increase in size until the whole interior becomes affected, and begins to shrink, causing the surface to become rough. In the last stage the fungus forms small cavities in the epidermis, in which the spores are produced. No opportunity has yet been found for applying a remedy.—*M. C. C.*

Bud-Variation (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 3, p. 216, with two coloured plates).—Although this article is concerned only with sugar-canes, it is nevertheless vastly interesting to students of bud-variation in any plants and also for the remarks of Dr. Morris urging the planters to be always on the look-out for specimens of bud-variation, which he says "are not mere curiosities, but might lead to the discovery of very valuable new varieties." And what is true of sugar-cane is true of all other plants. We fear many gardeners are apt to overlook this aspect of the subject.—*W. W.*

Bulb Culture in Ireland. By F. W. Burbidge (*Jour. Hort.* p. 551; December 19).—This is being carried on with success at Rush, County Dublin, and the soil and climate of Ireland are favourable for more extensive commercial ventures of this sort.—*C. W. D.*

Bulb Diseases. By C. Abbey (*Jour. Hort.* p. 264; September 19).—Suggestions are made for their prevention, by disinfecting both bulbs and soil before planting.—*C. W. D.*

Bulbs and Tubers for Unheated Greenhouse. By K. L. D. (*Gard.* p. 281; 26/10/1901). A very useful article on the most suitable bulbous flowers for the cold greenhouse, and how to grow them.
E. T. C.

Bulbophyllum Lobbii Nattesiæ (Cogniaux in *Dict. Icon. Orch. Bulb.*, pl. 1; 11/1901). A native of Java, originally discovered in 1846. This variety appeared in 1894, and was sent from Java by the Comte de Nattes. Flowers of curious shape; colour bronze and yellow with purple spots.—*C. C. H.*

Burbank, Luther. By Edward J. Wickson (*Sunset*, vol. viii., p. 57, No. 2, plates).—A sympathetic account of the life and home of Luther Burbank, the horticultural scientist, which is to be followed by further articles on his work.—*M. L. H.*

Cabbage Bug, Harlequin. By E. M. Willcox (*U.S.A. Exp. Stn. Oklahoma*, 1900; fig. 2).—This bug made its appearance this spring in considerable numbers on Rape and Cabbages. Very brief description is given of the insect (*Murgantia histrionica*). It is said that the bugs cannot be killed by spraying, and the only alternative is to burn up all rubbish in the winter.—*M. C. C.*

Cacao, Attack of Thrips on. By H. Maxwell-Lefroy (*Bull. Bot. Dep. Trinidad*, No. 28; May 1901).—A report, reprinted from the *Grenada Gazette*, of a visit to Grenada to study the attack of this insect. The writer regards "thrips" as a possible future, rather than present, enemy to Cacao; but in case of its increase, recommends spraying with (1) resin wash, (2) kerosene emulsion, or (3) whale oil soap. Full particulars of each treatment are given.—*E. A. B.*

Cacao, Fungoid Diseases of. By A. Howard (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 3, p. 190).—A most exhaustive article on the

numerous diseases attacking pod and stem and root of the Cacao. It should be thoroughly mastered by all planters of Cacao in tropical countries.—*W. W.*

Cacao, Three Fungoid Diseases of. By A. Howard (*Bull. Bot. Dep. Trinidad*, No. 30; August 1901).—Descriptions of these, and remedial measures against them, are clearly given. To one of them is now attributed the damage to pods formerly thought to be effected by "thrips."—*E. A. B.*

Cacti, Hardy. By F. Rehnelt (*Die Gart.* p. 121; 14/12/01; with illustration).—The hardy species of the Cacteæ mentioned are nearly all *Opuntiæ*, principally *O. camanchica*, *O. vulgaris*, *O. Hovei*, *O. polyacantha*, *O. barbata*, *O. horizontalis*, *O. Rafinesquei*. The Cactus stood the severe German winter, while the Common Bracken (*Pteris aquilina*) was killed.—*G. R.*

Calanthe × Veitchii, Lindl. (Cogniaux in *Dict. Icon. Orch.*, *Calanthe* hyb., pl. 1; 3/1901).—Raised by Dominy for Messrs. Veitch at Exeter in 1856, from *C. rosea* and *C. vestita*. This hybrid inherits the rich colour and characteristic column of *C. rosea* with the habit and four-lobed lip of *C. vestita* in a modified form. It has since been found in Burma as a natural hybrid by Boxall for Messrs. Low in 1893.

C. C. H.

Calanthe vestita rubro-oculata, Paxt. (Cogniaux in *Dict. Icon. Orch.*, *Calanthe*, pl. 1; 3/1901).—Flowers milk-white, with purple-carmine blotch at the base of the lip. Introduced by Messrs. J. Veitch & Sons from Moulmein in 1849.—*C. C. H.*

Calanthe vestita Stevensiana (Cogniaux in *Dict. Icon. Orch.*, *Calanthe*, pl. 1A; 5/1901).—Introduced from Cochin China in 1883, by M. Regnier. This plant is now called *C. Regnieri* var. *Stevensii*, Rolfe in *Orch. Rev.* 1901, p. 142.—*C. C. H.*

Calochorti and their Culture. By G. B. Mallett (*Gard.* p. 412; 21/12/1901).—A most exhaustive and valuable article on this comparatively little grown genus of exquisite Californian bulbs, describing the species and giving full cultural directions.—*E. T. C.*

Canna 'Comte de Sachs' (*Rev. Hort.* p. 395; September 1901).—Raised by MM. Billard & Barré. Foliage broad, green margined with reddish brown. Inflorescence 1 metre high; large flowers, brilliant red; highly recommended.—*C. D. T.*

Cannas, Orchid-flowered or Italian. By Ch. Sprenger (*Rev. Hort.* pp. 446-8; October 1901).—History of origin and development, with description of numerous varieties.—*C. T. D.*

Cantaloupe Blight. By H. H. Griffin (*U.S.A. Exp. Stn. Colorado*, June 1901).—This blight was first observed in 1896, and since found to be caused by *Macrosporium cucumerinum*. The first appearance is a large number of small brown spots on the leaves. The brown spots grow larger as

the fungus kills the tissue, until they occupy the whole leaf, which appears as though struck by frost. Spraying with Bordeaux mixture was attended with success, even when applied late in the season, when the blight was spreading rapidly. The virtue of the spraying lies largely in the ability of the Melons to ripen properly. Mr. Fenlason sold 300 crates of good Melons from his sprayed field of 1¾ acre.—*M. C. C.*

Capparis spinosa. Anon. (*Gard. Chron.* No. 775, p. 319, fig. 99; November 2, 1901).—It is suggested that this plant, which has large pinkish blossoms, should be oftener grown in sunny places in our southern counties, as it flourishes on dry walls and rocks in the Riviera, and has been flowered at several places in England. The unopened flower-buds, when pickled, form the culinary 'Capers.'—*G. S. S.*

'Carnation,' What is? By B. (*Gard. Chron.* No. 780, p. 105, December 7, 1901).—An article on the origin and meaning of the name Carnation, in which reference is made to various old authors who mention this plant.—*G. S. S.*

Caroline and Marian Islands, Sketch of a Journey to the. By Dr. Volkens (*Gartenflora*, p. 453; 1/9/1901).—An interesting account of a visit to these islands by way of Ceylon, Singapore, and Japan.

J. P.

Catasetum splendens Lindeni, Rolfe (Cogniaux in *Dict. Icon. Orch.*, *Catasetum* hyb., pl. 1; 3/1901).—This is considered to be a natural hybrid between *C. macrocarpum* and *C. Bungerothi*, with which it grows in North Brazil and part of Venezuela, and introduced by Messrs. Linden, of Brussels, in 1894 (see also Rolfe in *Orch. Rev.* 1894, p. 356).—*C. C. H.*

Caterpillars, Tent. Anon. (*Jour. Bd. Agr.* vol. viii. pp. 191 197, with two f.p. illustrations).—Two species of moths are dealt with, the common "lackey moth" (*Clisiocampa neustria*, Linn.) and the very local brown-tail moth (*Porthesia chrysorrhœa*, Linn.). The latter is recorded as having been abundant last year in Kent. It is recommended that whenever practicable the eggs of the "lackey moth" should be collected and destroyed; and that the "tents" or webs containing the hibernating larvæ of brown-tail should be similarly treated. "A great deal of damage will be saved by spraying as soon as the attack is noticed, especially when the tents cannot be reached. For this purpose arsenical washes should be used. Of these washes the three best known are Paris green, London purple, and arsenate of lead. The latter is the best wash of the three, killing the larvæ and yet not damaging the leafage, as sometimes happens with Paris green."

"*Paris Green Wash* is made as follows:—Add ½ lb. Paris green to 100 gallons of water, and mix up 1 lb. of lime with the same. This must be kept well stirred. Paris green can be used where poultry and stock are kept, the quantity applied to the trees being so small that it will have no effect upon animals."

London Purple is prepared in the same way as the above, the lime being again essential.

"*Arsenate of Lead* is prepared as follows:—Dissolve 1 oz. of arsenate of soda in warm water, and add to 16 gallons of soft water. Then dissolve 3 oz. of acetate of lead in water, and pour into the 16 gallons of liquid. Add to this 2 lb. of treacle. In the place of treacle the arsenate of lead wash may be mixed with paraffin emulsion, and so a double insecticide prepared. This wash when properly mixed is most successful, and never burns the leafage, as growers often find to be the case with Paris green.

"In all cases proper sprayers must be used with fine nozzles, so that a dense mist of the wash may be thrown on the trees."—*R. N.*

Cattleya × calummata Grignani, L. Lind. (L. Linden in *Lind.* xvi. pl. 749; 5/9/1901).—A hybrid raised by M. Dallemagne, of Rambouillet, in 1901, between *C. Acklandiae* and *C. intermedia.* Flowers undulate, rosy-white, with many purple spots; lip white below, rich purple above, and citron-yellow between. *C. C. H.*

Cattleya Eldorado Wallisii, Rand. (Cogniaux in *Dict. Icon. Orch.*, *Cattleya*, pl. 26A; 5/1901).—An albino of the type originally discovered by Wallis for Linden in 1865, in North Brazil.—*C. C. H.*

Cattleya × Elisabethæ, L. Lind. (L. Linden in *Lind.* xvi. pl. 721; 1/1/1901).—A hybrid obtained in 1900 by Messrs. Linden, of Brussels, out of *C. Mossiae* by *C. Schilleriana*, and hence a variety of *C.* × *Harrisiae*, colloquially known as *C.* × 'Miss Harris.' Flowers intermediate in form and colour except the lip, which is very near to *C. Schilleriana.*—*C. C. H.*

Cattleya × Hardyana alba, Rolfe (Cogniaux in *Dict. Icon. Orch.*, *Cattleya* hyb., pl. 2A; 5/1901). -A lovely natural hybrid between *C. Dowiana aurea* and *C. Warscewiczii*, found with its parents in Colombia. Sepals and petals snow-white, lip almost as in the type. First introduced in 1895. The typical hybrid has been raised in gardens, thus demonstrating its parentage.—*C. C. H.*

Cattleya Harrisoniana alba, Beer. (Cogniaux in *Dict. Icon. Orch.*, *Cattleya*, pl. 17A; 3/1901).—An albino of the type found in the province of Rio de Janeiro, Brazil. Flowers pure white, sometimes lightly tinted with yellow or rose. Originally described in 1854.
C. C. H.

Cattleya labiata tessellata (Oakes Ames in *Amer. Gard.* xxii. p. 669; 28/9/1901).—Sepals, petals, and lip pale mauve, with a closely woven network of bright purple.—*C. C. H.*

Cattleya × Lansbergei, L. Lind. (L. Linden in *Lind.* 1901, xvi. pl. 725; 1/2/1901).—A hybrid raised by Messrs. Linden in 1900 from *C. Dowiana aurea* and *C. labiata*, and hence a variety of *C.* × *Fabia.* Flowers rose, lip with large orange base, apex purple-crimson, margined rose.—*C. C. H.*

Cattleya × Maronii (J. E. Rothwell in *Amer. Gard.* xxii. p. 879, fig. 180; 28/12/1901).—This hybrid was first raised by M. Maron in 1898, from *C. velutina* ♀ × *C. Dowiana aurea* ♂. Sepals and petals nankeen yellow, lip pale orange suffused rose, with crimson veins. The photograph shows the pseudo-bulbs to be more like *C. velutina*, though shorter and thicker; as in *C. velutina*, each is two-leaved, though the leaves are longer and narrower, as in *C. Dowiana*. In this case the inflorescence is four-flowered; but, curiously enough, the purple spots on the sepals and petals and the white lip of *C. velutina* are quite obliterated.
C. C. H.

Cattleya Mossiæ 'Mme. Lucien Linden,' Hort. Wavrin (L. Linden in *Lind.* xvi. pl. 733; 1/5/1901). A beautiful variety from the collection of the Marquis de Wavrin. Sepals and petals pure white; lip with apical blotch of lilac-rose, throat beautifully marked with purple and yellow on a white ground.—*C. C. H.*

Cattleya × Portia Rothwelliæ (Oakes Ames in *Amer. Gard.* xxii. p. 845, fig. 174; 14/12/1901).—A new hybrid between *C. labiata Eldorado* and *C. Bowringiana*, raised by Mr. J. E. Rothwell, of Brookline, Mass. Habit intermediate. Flowers $4\frac{1}{4}$ inches across, pale purple-red, front of lip and margins of side-lobes rich purple-red, throat rich yellow. As *C. Eldorado* is now classed as a distinct species, this hybrid should be named *C.* × *Rothwelliæ*. (See *Gard. Chron.* 1902, xxxi. p. 18.)
C. C. H.

Cattleya Trianæi Schroderæ alba (Cogniaux in *Dict. Icon. Orch.*, *Cattleya*, pl. 5a; 9 1901). An albino of *C. Schroderæ*; flowers pure white with yellow throat.—*C. C. H.*

Cattleya violacea, Rolfe (Cogniaux in *Dict. Icon. Orch.*, *Cattleya*, pl. 28; 11/1901). A widely distributed species from S. America, first introduced in 1838. Flowers fragrant, bright purple rose tinged with white; lip crimson purple, with white and yellow base.—*C. C. H.*

Cattleya Walkeriana, Gardn. (Cogniaux in *Dict. Icon. Orch.*, *Cattleya*, pl. 27; 8 1901).—Originally described in 1843. Flowers rosy-purple, lip fleshy, three-lobed, veined purple, with yellow base. A native of Brazil.—*C. C. H.*

Ceanothus Fendleri. By Ed. André (*Rev. Hort.* pp. 422–3; September 1901).—Two woodcuts showing habit and flowers. Bushy shrub about 1 metre high. Native of Colorado. Myrtle-like leaves and numerous white flowers; perfectly hardy; flowers in June. Highly recommended for rockeries.—*C. T. D.*

Ceanothus 'Rose Carmin.' By Ed. André (*Rev. Hort.* pp. 445–6; October 1901; 1 illustration).—Raised by MM. Simon-Louis frères, Plantières, near Metz. Very distinct summer-flowering shrub. Other rose-coloured varieties are cited as good, viz.: 'Albert Pillet,' 'Ceres,' 'Ibis rose,' 'Marie Simon,' 'Spectabilis roseus,' but none surpass 'Rose Carmin.' These shrubs are strongly recommended for grouping in gardens in conjunction with the blue and lilac types.—*C. T. D.*

Celery Culture (*U.S.A. Dep. Agr. Bull.* 133, *Exp. Stn. Work*, xviii. 1901; illustrated).—Celery-growing first became an industry in the United States, near New York, about 1858. It is now grown to supply a summer and autumn as well as winter demand.

Culture in the North differs somewhat from that in the South. In the former the Celery is generally lifted and blanched in trenches or the cellar, while in the latter it is blanched in place and not lifted.

Various States have contributed information as to the cultivation, &c., of Celery.

The fertilisers chiefly indicated are nitrogen and potash. Amongst the methods employed for blanching are: Earthing up; the use of boards about a foot wide; drain-tiles, stiff wrapping-paper, &c. and in the "new Celery culture" the growing of self-blanching varieties in rows 8 to 12 inches apart either way, with boards on the outside only, the plants thus shading and blanching themselves.

Irrigation is necessary in some form, and sub-irrigation, when not deeper than 6 inches below the surface, has been found preferable to surface irrigation.

The early market demand in May and June has necessitated forcing, and for this purpose seeds are sown in late autumn or early winter, when the plants are ready for blanching a couple of months later. The best method of blanching this early crop is found to be the use of lengths of stiff wrapping-paper tied round the plant at two intervals of time.

The bulletin deals besides with the different varieties and the relative merits of different kinds of storage, especially cellars and trenches for winter use.—*C. H. C.*

Celery, Notes on Experiments. By Ernest Walker (*U.S.A. Exp. Stn. Arkansas Bull.* No. 64; December 1900).—A detailed account of Celery culture in Arkansas, where practically it had previously received no attention. Some few insect pests made their appearance with the Celery blight, *Cercospora apii*, but none of them caused trouble.—*M. C. C.*

Celery Rust, Suggestions. By Prof. C. O. Townsend (*U.S.A. Hort. Soc., Maryland*, 1899).—Experiments made for treatment of this rust led to the conclusion that the rust may be controlled by spraying, that ammoniacal carbonate promises better results than Bordeaux mixture, and that shading is only partially successful in preventing Celery rust.

M. C. C.

Centrosomes. By S. Yamanouchi, Tokio (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 301-304, with 1 plate).—The author describes and figures centrosomes from the pollen-mothercells of *Lilium longiflorum*.

G. F. S.-E.

Cereus peruvianus, Mill. By Cuno Becker (*Die Gart.* p. 184; 21/12/01).—Illustration of a fine specimen of this Cactus growing at the garden of the Casino, Monte Carlo. Over 800 flowers were open at one time. The height of the plant is about 34 feet, and the circumference of the lower trunk is about 4 feet.—*G. R.*

Chinese Forests, Midst. By Dr. Henry (*Garden*, No. 1,572, p. 3; 4/1/1902).—An account, of absorbing interest, of Dr. Augustine Henry's botanical travels in China. Dr. Henry describes many new and rare plants that he found growing wild, and also the positions he found them in. Many Lilies, including *Lilium Henryi*, the great coniferous forests, the wild fruits, mangrove swamps, and many other points of interest are mentioned.—*E. T. C.*

Chondrorhyncha Chestertoni major (Cogniaux in *Dict. Icon. Orch., Chondr.*, pl. 1; 8/1901).—Introduced from Colombia by Messrs. Linden, of Brussels, in 1893. The variety is much larger than the type, which has clear yellow flowers, save the base of the lip, which is orange-yellow with purple-brown spots. The lip is finely fringed.—*C. C. H.*

Chrysanthemum Rust. By J. C. Arthur (*U.S.A. Exp. Stn. Indiana Bull.*, 85; 10/1900).—Describes the disease, details experiments tending to prove that the fungus (*Puccinia chrysanthemi*) which produces the rust is peculiar to the Chrysanthemum, and suggests preventive measures.—*F. J. C.*

Chrysanthemums, Colours of (*Rev. Hort.* p. 443; October 1901).—A commission has been sitting in Paris to determine the definite colours, and M. René Oberthur has undertaken to publish the results obtained by submitting numbered specimens to numerous growers, and collating their pronouncements in conjunction with those of a committee of horticulturists, painters, dyers, and chemists, who will fix the definite tint names. These will be translated into several languages prior to publication.—*C. T. D.*

Chrysanthemums, New Japanese. By D. B. Crane (*Garden*, No. 1,574, p. 37, 18/1/1902; No. 1,576, p. 76, 1/2/1902; No. 1,580, p. 143, 1/3/1902).—A detailed description of varieties that have for the most part gained distinction from the National Chrysanthemum Society or from the Royal Horticultural Society. A few additional varieties of merit that failed to obtain recognition from some trifling cause are also included. Each variety is arranged in the class to which it belongs, so that its characteristics may be seen at a glance.—*E. T. C.*

Chrysanthemums, New Mode of taking Cuttings. By Gustav Curtois (*Rev. Hort.* pp. 475-6; October 1901).—Basal growths induced by cutting down after flowering are taken as cuttings in October and November; potted and placed in cold frames they root rapidly and strongly. This system is recommended as far better than the usual one of removing the shoots to frames and taking cuttings in spring. Pots are embedded in ashes. Ready for planting out in March.—*C. T. D.*

Chrysanthemum, Propagating Sports. By H. Dauthenay (*Rev. Hort.* pp. 529-30, November 1901; 1 woodcut).—Instructions for raising from bud sports by layering.—*C. T. D.*

Chrysanthemums, Spidery. By D. B. Crane (*Garden*, No. 1,572, p. 11; 4/1/1902).—This article draws attention to the many beautiful and useful varieties to be found in this section of the Chrysanthemum. All the best varieties are described, including the more recent ones.

E. T. C.

Chrysanthemums—Taking the Buds beginning of October. By H. Dauthenay (*Rev. Hort.* pp. 453-6; October 1901).—Six woodcuts illustrating stages of growth for disbudding, &c.—*C. T. D.*

Chrysanthemums, To Grow. By M. C. Renault (*Ann. Soc. Nant.* p. 101, 1901, 3rd quart.).—Describes some most satisfactory results in size of bloom from cuttings taken in the first days of June, grown on under very liberal treatment in the open ground and potted up in autumn. The cuttings were taken at haphazard from an ordinary collection, but the author suggests that by choosing show varieties show blooms would be obtained by the same simple system.—*M. L. H.*

Chysis lævis, Lindl. (L. Lind. in *Lind.* xvi. pl. 726; 1/2/1901).—Introduced from Mexico in 1839. Flowers yellow, richly shaded with orange-red.—*C. C. H.*

Chysis Limminghei, Lind. et Rchb. f.—Discovered in Mexico in 1855. Flowers white, tipped with rosy purple; lip yellow and white, lined purple crimson. *C. C. H.*

Clematis brachiata. Anon. (*Gard. Chron.* No. 778, p. 367, fig. 111, November 23, 1901).—A greenhouse plant with greenish-white, deliciously fragrant blossoms; would probably be hardy except in severe winters. It is a native of South Africa.—*G. S. S.*

Clover Anthracose. By B. Mehner (*Zeit. f. Pflanz.* xi. pp. 193-196; 11 1901).—A disease injuring Red Clover in Saxony is identified as *Glœsporium trifolii*, Peck, hitherto known only in America. It forms on stems and leaf-stalks long (½ to 1½ inch) narrow spots, which at first are dark brown, but later have a light-brown centre and dark-brown margin. At first superficial, the spots penetrate into the pith, then the leaves die. Conidia were obtained abundantly, and infection of healthy plants produced the disease. Damage was distinctly greater in fields where American Red Clover seed was used, and the suspicion is that the fungus has been introduced with the seed; once present, however, it attacks other varieties of Red Clover. Prevention and treatment experiments are in progress.—*W. G. S.*

Cocoa-nut Butter. By J. R. Jackson (*Gard. Chron.* No. 782, p. 449, figs. 135 and 136, December 21, 1901).—This substance has lately attracted a good deal of attention; its manufacture in this country and on the Continent is now very considerable. It is manufactured from the kernels of cocoa-nuts, and is used as a substitute for butter or lard in cooking. It is sold in Germany at about 8*d.* per lb. It is claimed that

it contains more than 90 per cent. of vegetable fat, and that it is more wholesome and easier digested than the ordinary fat used for baking and cooking. It is said to be much in demand amongst vegetarians, Jews, and Mahommedans. In English trade it is known as Nucoline.—*G. S. S.*

Cocoa-nut, the "Claret" or "Green" (*Bull. Bot. Dep. Trinidad* No. 29, p. 358 ; July 1901).—A superior variety, with larger fruit, found growing with the ordinary form at Tobago.—*E. A. B.*

Cocoa Palm, The Origin and Distribution of the. By O. F. Cook (*U.S.A. Dep. Agr., Div. Bot., U.S. Nat. Herb.* vol. vii. No. 2 ; 1901).—The current opinions and popular inferences as to its origin and distribution are given. The improbability of Spanish introduction is ably discussed, together with early Spanish accounts of the Cocoa Palm in ancient America, and methods of its introduction to the Atlantic coasts. The American names of the Cocoa-nut are given, with botanical evidence and prehistoric introduction of other plants, thus tending to prove the Cocoa Palm an American species.

The dissemination of the Cocoa Palm with the origin of its varieties and failure of maritime distribution in Australia point to the ineffectiveness of ocean currents, thus rendering human assistance in some form necessary.

The original habitat of the Cocoa Palm, with the direction of the trans-Pacific distribution, is followed by a summary of De Candolle's arguments from which conclusions are drawn.—*E. F. H.*

Cœlogyne barbata, Griff. (L. Linden in *Lind.* xvi. pl. 735 ; 1/5/1901).—Introduced from Bhotan in 1879 by Mr. Bull. Flowers white, with dark-brown fringed lip.—*C. C. H.*

Coffee Plant, Diseases, in Brazil. By F. Noack (*Zeit. f. Pflanz.* xi. pp. 196–208, pl. iv. ; 11/1901).—A description of the mode of attack and the characters of the following fungi parasitic on Coffee plants: (1) *Cercospora coffeicola*, Berk et Cooke (including *Ramularia Goeldiana*, Sacc.) ; (2) *Mycosphærella coffeæ*, n. sp. ; (3) *Colletotrichum coffeanum*, n. sp.—*W. G. S.*

Colchicums. By W. Irving (*Garden*, No. 1,572, p. 8 ; 4/1/1902) The known species are described, and a coloured plate of *C. Sibthorpii* is given. They are divided into four groups, the distinguishing features being described. Mr. Irving also gives information on the culture of the Colchicums.—*E. T. C.*

Cold Storage. By L. C. Corbett (*U.S.A. Exp. Stn. West Virginia Bull.* 74 ; 8/1901).—The pamphlet gives plans and elevations of suitable cold storage rooms for Apples ; information as to the least quantity which it pays to store ; the best temperature at which to keep the store-room ; and the amount of loss likely to arise from shrinkage and decay.

The following useful table of temperatures for fruit and vegetable

storage is quoted in the pamphlet from "Compend. of Mechanical Refrigeration," by J. E. Seibel :—

Fruits.	° F.
Apples	32-34
Bananas	34-36
Berries (fresh, for 3 or 4 days)	34-36
Cantaloupes (only about 3 weeks)	32
Cranberries	33 34
Dates, Figs, &c.	34
Fruits (dried)	35-40
Grapes	33 36
Lemons	34 40
Oranges	36
Peaches	35-45
Pears	33 36
Water-melons (only about 3 weeks)	32
Asparagus	34
Cabbage	32 34
Carrots	33 34
Celery	33 35
Dried Beans	32 40
Dried Corn	35
Dried Peas	40
Onions	32 34
Parsnips	33 34
Potatos	34 36

"The spoiling of fruit at a temperature below 40° F. is due to moisture."—*F. J. C.*

Colorado Beetle, The (*Doryphora* (*Leptinotarsa*) *decemlineata*, Say.) By F. V. Theobald (*Jour. Bd. Agr.* vol. viii. No. 2, pp. 147-154, with a coloured plate).—This article gives an account of the recent occurrence of this pest at Tilbury. "The infested plot was burnt with paraffin and the ground soaked with the same, and then heavily dressed with gas lime, which was deeply ploughed in. All the surrounding herbage was cut and burnt, and also dressed with gas lime." And the country for a radius of 3½ miles was searched, without revealing a single beetle. This information is followed by an account of the life-history of the beetle, and is illustrated by a beautiful coloured plate by T. W. Frohawk. A list of the food-plants is also given, including those upon which the insects were found feeding at Tilbury. These included the Woody Nightshade, Cabbage and Thistles, whilst the eggs were found in one case on Sow Thistle (*Sonchus*). As to the possibilities of the insect living in England, the author states that "although we have no member of the genus *Doryphora* living in Europe, there seems no reason why this particular species should not live and become perpetually established. The climatic conditions of this country are by no means inimical to the Colorado beetle. The insect, says Riley, is northern rather than southern in its native habitat. The larvæ, according to Riley, cannot withstand any great variation in temperature; they do not thrive, he says, where

the thermometer has a range of 100 degrees Fahrenheit. Moreover, the larvæ cannot stand the hot burning sun; they like a humid atmosphere. Its northern spread is probably unlimited, until the Arctic region is reached, for prolonged frosts do not affect the hibernating beetles. The greater length of winter and the greater cold would only reduce the number of broods.

"Yet we must not forget that the genus to which this germ belongs is southern rather than northern, the Colorado beetle itself occurring as far south as Mexico. It breeds and flourishes in numbers in Kansas, and in places where the temperature has a still greater range, so that too much reliance cannot be placed on Riley's statement referred to above."

The concluding chapters deal with the natural enemies and closely related beetles.—*R. N.*

Commercial Fertilisers (*U.S.A. Exp. Stn. Kentucky Bull.* 95; September 1901).—This bulletin contains an elaborate series of tables of the results of analysis of a large number of commercial fertilisers, with the names of the manufacturers, name of the brand, and percentage of constituents. See also *Exp. Stn. Connecticut*, 1901.—*M. C. C.*

Composts for General Potting. By H. Dauthenay (*Rev. Hort.* pp. 477–80; October 1901).—A long and interesting article specifying composts used by numerous specialists for various plants for cuttings and potting on.—*C. T. D.*

Cork-Oaks. By J. Daveau (*Bull. Soc. Bot. France*, xlvi. 1899; Sess. Extraord. à Hyères, Mai 1899 (published November 1901), pp. lxxxvi–xci).—Discusses the specific distinctness of the two Cork-oaks, *Quercus Suber*, L., and *Q. occidentalis*, Gay. The conclusion arrived at is, that in Spain, Portugal, and Algeria there is no sufficient ground for separating the two as species. In France *Q. occidentalis* appears to be a race adapted to an Atlantic climate. It is distinguished by its deciduous foliage, and by the acorn taking two years, instead of only one, to ripen *A. W. B.*

Cosmos, Hybrids of, and Autumn Sowings. By Gustave Courtois (*Rev. Hort.* pp. 480–1; October 1901).—Two woodcuts of a large flowering hybrid (? cross or sport) of *C. bipinnatus*. Handsome plant, with flowers 2½ inches in diameter, with finely dissected foliage. Autumn sowing advisable, as the new form flowers later than the normal. Stands a little frost, but not hardy.—*C. T. D.*

Crab Trees. By E. D. S. (*Jour. Hort.* p. 440; November 14).—Several kinds are mentioned, which are ornamental both in flower and in fruit.—*C. W. D.*

Crassula tenuis. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 399; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Cratægus, The Genus. By W. J. Bean (*Gard. Mag.* 2,511, p. 826; 14/12/1901).—A descriptive account of the cultivated species of *Cratægus* (Thorns), written in the same thorough way as previous articles on trees

and shrubs from this writer. The species are grouped geographically, and descriptions are given of the most important for general cultivation. Illustrations are given of the Weeping Hawthorn and the double Pink Thorn on the lawns at Kew.—*W. G.*

Crinum crassipes. By A. Worsley (*Gard. Chron.* No. 780, p. 417, December 7, 1901).—This fine species has a bulb some 3 feet in length and 10 inches in diameter, with leaves 6 feet in length and from 6 to 8 inches broad, which grow in whorls forming a fountain of huge leaves. It throws up several flower stems in the course of the summer; each bears a large number of flowers 5 or 6 inches in diameter. Notes on the cultivation of Crinums are also given.—*G. S. S.*

Crinums—Culture of Hardy Species. By G. B. Mallett (*Gard. Chron.* No. 769, p. 221; September 21, 1901).—Several species belonging to the genus *Crinum* are mentioned as being hardy. The best soil and positions in gardens are given, and much general information about them.
G. S. S.

Crocuses, Autumn and Winter Flowering. By "G. R." (*Gard.* p. 346; 23/11/1901).—Short notes describing the best of these charming little flowers, with cultural notes.—*E. T. C.*

Crows and Rooks in Relation to Agriculture (*Kais. Ges. Biol. Abt.* i. 1900).—Three papers issued by the Gesundheitsamt of Berlin together constitute a bulky monograph on the question of the part played by crows and rooks in agricultural operations, and contain much information alike for the grower of plants and the student of birds. The three papers deal with different questions raised in one investigation. The more important is that by Dr. Rorig on "The Relations of the Crows of Germany to Agriculture and Forestry"; it extends to over a hundred pages, with an additional 150 pages of statistics. The nature of the research may be gathered from a few details. The rook, hooded crow, and carrion crow are selected for investigation. From November 1896 to November 1899 5,148 specimens were received from all parts of Germany; 1,523 were rooks, 3,259 hooded and carrion crows with hybrids (of which illustrations are given); the remainder, having no contents in stomachs, were rejected. An aggregate of the stomach-contents of the 1,523 rooks shows that 26·6 per cent. was stones or earth, 46·9 per cent. plant-remains, and 25·5 per cent. animal-remains. The plant-remains included: Wheat, 5·6 per cent. of total food, Barley 6·3 per cent., Oats 8·6 per cent., Rye 1·6 per cent., other seeds 1·9 per cent., the remainder being miscellaneous material, including animal excreta. By observations and by dividing the year into four periods, it is shown that the plant-material was not all actually growing; thus, only about half the Wheat could have been obtained from growing crops. The animal-remains are analysed in a similar detailed way. The final result in regard to rooks is estimated thus: Total damage per annum by 1,523 rooks £680, benefits conferred in destroying insects, &c., about £1,000, leaving a balance of £320 to the benefit of agriculture. The 3,200 hooded and carrion crows are also examined in like detail, and with somewhat similar results. That crows and rooks do so little damage

as the results show is hard to believe, yet the exact details of the paper look convincing. The killing of crows and rooks is strongly condemned; scaring from crops liable to depredation is recommended; and a comparison of various methods is made. The one advocated is to hang dead crows or parts of them at frequent intervals.

A second paper by Dr. Rörig (18 pp.) deals with "Distribution of the Rook in Germany." Two charts show by shading (1) the relative number of colonies, (2) the number of nests per unit of area. The rook is abundant in North Germany and gradually disappears towards the Southern States. Interesting details of mode of life, nesting, and the effects of bounties for extermination are also given.

The third paper (31 pp.), by Dr. A. Jacobi, is an inquiry into the "Swallowing of Stones by Birds." A list of birds shows to what extent they swallow stony material. The question why birds take stones, and under what circumstances, is dealt with. It is proved from the 5,000 rooks and crows of Dr. Rörig's work that they at least swallow more stones with plant food than with animal, and that more stones are eaten in cold weather than during seasons when plants are in growth. Other questions, including the ejection of swallowed stones, are considered.

W. G. S.

Cucumbers, Proliferous. By M. T. M. (*Gard. Chron.* No. 769, p. 229, figs. 67 and 68; September 21, 1901).—Some very curious monstrous Cucumbers are described and figured in this article, the abnormalities of the flowers being particularly interesting.—*G. S. S.*

Currant Aphides (*Ropalosiphum ribis*, Linn., and *Myzus ribis*, Linn.). Anon. (*Jour. Bd. Agr.* vol. viii., No. 3, pp. 306–312, with illustrations).—The method of prevention and remedy is given as follows: "Little can be done to prevent the attack of these Currant lice. Black Currants should be cut very low in the autumn after an attack, and the strippings carried away and burnt. By so doing many eggs will be destroyed. Probably some benefit would be derived by the winter washing with caustic alkali wash. The use of this spray is not only to rid the plant of vegetable encumbrances—moss and lichens which shelter various hibernating insects—but it also affects the eggs of certain insects, such as the *Psyllidæ* and some *Aphididæ*. It will also remove the brown scale, *Lecanium ribis*, often noticed on Currant and Gooseberry bushes.

"Caustic alkali wash is prepared in the following way: Dissolve 1 lb of caustic soda and 1 lb. of carbonate of potash separately in water, then mix the two together and add to 10 gallons of soft water, then add to this ½ to ¾ lb. of dissolved soft soap (Chiswick), or 1 lb. of coarse treacle. Spray over the bushes about February. It is most important to spray the bushes early in the year, directly the lice are seen and before the blisters are formed."—*R. N.*

Cycas revoluta, Flowering of Male Plant. By P. Baccarini (*Bull. R. Soc. Tosc. Ort.* 9, p. 257; Sept. 1901).—A plant growing in the open all the year round in the garden, Via Pinti, of the Marchioness Paolucci Panciatichi. Measurements of the rate of development of the cone, and the date—viz. the 12th August—of its attaining complete

expansion, are given. Male specimens are known neither in Italy, Palermo, nor the Riviera. But in Mr. Hanbury's garden at La Mortola are some plants which, although they have not flowered, are suspected of being male. Miquel mentions a male specimen cultivated in the Botanic Garden of St. Petersburg which flowered twice before 1839. About 1850 there is mention of one in flower at Sheffield. In 1891 Nicholson describes a male plant flowering in the neighbourhood of London. Travellers assert that in their native countries the male plants are rare as compared with the female; Thunberg saw none in Japan, Kegel searched in vain for them in Surinam, and in some parts of Japan the plant even now fails to mature its fruit owing to the absence of male individuals. The author mentions the propagation of *Cycas* by bulbs, and the preference given to the female plants in the East, owing to its producing a better quality of sago and in greater quantity than the male. A short diagnostic sketch of the characters is given. Accompanying the article is a good photograph of a male cone, and two woodcuts of stamens.

W. C. W.

Cyclamen pseud-ibericum nov. sp. By Frederick Hildebrand (*Gartenflora*, p. 573, 1/11/1901).—A detailed account of an apparently undescribed species of *Cyclamen* sent to the author by C. G. von Tubergen, jun., of Haarlem. Its origin is at present unknown. The plant resembles *C. ibericum* in its flower, but the corm has a corky surface instead of a hairy one. The flowers, which appear in spring, are fragrant, reddish-violet, with a pure white ring round the throat of the corolla, flecked with a dark-violet spot.—*J. P.*

Cyclamens of Dresden, The Frilled. By Franz Ledien (*Garden*, No. 1,580, p. 139; 1/3/1902).—An illustrated notice of a new race of Cyclamens raised and fixed in the nursery of Alwin Richter at Dresden. The parent type, *C. persicum giganteum*, was imported from England some twenty years ago. A full description of the flowers and the colours is given.—*E. T. C.*

Cymbidium × eburneo-Lowianum mureauense (Otto Ballif in *Chron. Orch.* p. 323; 5/1901).—Raised by M. C. Vivé, of Mureaux (Seine-et-Oise, France), out of *C. Lowianum concolor* by *C. eburneum*. Segments of the flowers cream-white, lip narrowly margined with purple; the peculiar yellow tint of the flowers recalls that of the parent *C. L. concolor*.—*C. C. H.*

Cypripedium × Albertianum rotundiflorum (L. Linden in *Lind.* xvi. pl. 734; 1/5/1901).—A hybrid raised from *C. Spicerianum* and *C. insigne Wallacei*, and hence a variety of *Paphiopedilum* × *Leeanum*. Flower large and broad, with the upper sepal, petals, lip, and staminode strongly suffused with rosy purple.—*C. C. H.*

Cypripedium × bruxellense, L. Lind. (L. Linden in *Lind.* xvi. pl. 751; 5/9/1901).—A hybrid between *C. Rothschildianum* and *C. venustum*, raised by Messrs. Linden, of Brussels. Fairly intermediate in form and colour; petals long and broad, covered with large spots, staminode curiously near to *C. Rothschildianum*.—*C. C. H.*

Cypripedium × Drapsianum, L. Lind. (L. Linden in *Lind.* xvi. pl. 724; 1/1/1901).—A hybrid raised by M. Draps-Dom out of *C.* × *Leeanum burfordiense* by *C. villosum*, and hence one of the numerous varieties of *Paphiopedilum* × *Leeander*. Upper sepal broad, white with tawny base and many large violet spots. Lower sepal spotted, broadly margined white, petals bronze and yellow, lip reddish-brown.—*C. C. H.*

Cypripedium Exul aurantiacum, L. Lind. (L. Linden in *Lind.* xvi. pl. 746; 15/9/1901).—This variety was first flowered by Messrs. Linden, of Brussels, in 1901. Petals and lip rich orange-yellow.—*C. C. H.*

Cypripedium insigne Chantini Lindeni, Grign. (L. Linden in *Lind.* xvi. pl. 738; 1/5/1901).—A yellow form of *C. insigne*, of good shape, but the spots are less prominent than in the var. *Chantini*. It appeared with Messrs. Linden, of Brussels, in 1901.—*C. C. H.*

Cypripedium × Kubele, Reg. Young.—A new hybrid raised by Mr. Reginald Young, of Liverpool, in 1901, out of *C.* × *œnanthum superbum* by *C.* × *Youngianum*, thus having a pedigree of five distinct species, viz.: *C. barbatum*, *C. villosum*, *C. insigne*, *C. philippinense*, and *C. superbiens*, all of which are more or less traceable in the hybrid. The standard is white, thickly spotted with blackish purple, and lined with green; petals long, with purple spots towards the base.—*C. C. H.*

Cypripedium × Lansbergeæ, L. Lind. (L. Linden in *Lind.* xvi. pl. 727; 1/2/1901).—A hybrid raised by Messrs. Linden, of Brussels, in 1900, and recorded as between *C. bellatulum* and *C. Boxallii*, but in the figure there is no trace of the latter, while there are many signs that *C. Lawrenceanum* was the other parent—*e.g.* colour of leaves, horizontal petals with ciliate and warty margins, shape of the lip, &c. This hybrid should be classed as a variety of *Paphiopedilum* × *Lawrebel*. Flowers rich purple-red, with leaves beautifully marbled.—*C. C. H.*

Cypripedium × Lathamianum latissimum (L. Linden in *Lind.* xvi. pl. 732; 1/3/1901).—A fine variety of this well-known hybrid, raised by M. Jules Hye, of Ghent, from *C. Spicerianum* and *C. villosum*. Flowers very large, broad, upper sepal white suffused rosy purple, with broad dark band; petals, lip, and staminode tinged rosy purple.—*C. C. H.*

Cypripedium Martin-Cahuzac (*Rev. Hort.* p. 419; September 1901).—*C. Charlesworthii* × *C. Io grande*, obtained by M. Cappe fils, Vésinet. Described fully as one of the prettiest of the Charlesworthii crosses.—*C. T. D.*

Cypripedium × Minos Youngii (Cogniaux in *Dict. Icon. Orch., Cyp.* hyb., pl. 47; 8/1901).—Raised by Mr. Reginald Young, of Liverpool, out of *C. Spicerianum magnificum* by *C.* × *Arthurianum*, the latter itself being a hybrid from *C. Fairieanum* and *C. insigne*. The upper sepal resembles a broad *C.* × *Leeanum superbum*, while the petals are short and broad.—*C. C. H.*

Cypripedium × radiosum Roeblingianum (Oakes Ames in *Amer. Gard.* xxii. p. 669; 28/9/1901).—An "albino" variety of the type raised by Mr. H. T. Clinkaberry, in the Roebling collection, by crossing *C. Lawrenceanum Pitcherianum* with *C. Spicerianum.* It is interesting to note that the dark-coloured var. of *C. Lawrenceanum* used as a parent produced several highly coloured seedlings, but this one out of the same batch is practically an "albino," the purple colour of the type being replaced by a delicate shade of yellow green.—*C. C. H.*

Cypripedium Rothschildianum-Augustum (*Rev. Hort.* p. 515; November 1901).—Cross between *C. R.* and *C. A.* Described as a superb vigorous form, with richly marbled foliage and flowers, combining the characters of both parents. One of the finest hybrids yet obtained. Raised by M. Bleu.—*C. T. D.*

Cypripedium × Swinburnei, O'Brien (Cogniaux in *Dict. Icon. Orch., Cyp.* hyb., pl. 48; 5/1901).—A hybrid obtained by Messrs. Heath, of Cheltenham, from *C. insigne Maulei* ♀ and *C. argus* ♂ in 1892.
C. C. H.

Cypripedium × Vitazo (Oakes Ames in *Amer. Gard.* xxii. p. 731; 26/10/1901).—A new secondary hybrid involving three species, flowered by Mr. A. J. Loveless, of Lenox, Mass., and obtained by crossing *C.* × *Gowerianum* (which is itself a hybrid between *C. Lawrenceanum* and *C. Curtisii*) and *C. Charlesworthii*, and, as one might expect, the last species largely predominates.—*C. C. H.*

Cypripedium × wyndhurstense (Oakes Ames in *Amer. Gard.* xxii. p. 731; 26/10/1901).—A new secondary hybrid flowered by Mr. A. J. Loveless, of Lenox, Mass., and obtained by crossing *C.* × *Euryale Robinsonianum* with *C. Charlesworthii.* The former parent is from *C. Lawrenceanum* and *C. superbiens*, so that three species are involved in the pedigree, and as is usually the case the pure species predominates largely over the hybrid parent.—*C. C. H.*

Cypripedium × Youngiæ (Cogniaux in *Dict. Icon. Orch., Cyp. hyb.*, pl. 49; 9/1901).—An interesting new hybrid raised by Mr. Reginald Young, of Liverpool, from *C. bellatulum* ♀ × *C. Hookeræ Volonteanum* ♂. Flowers creamy white, densely spotted and suffused with vinous purple.—*C. C. H.*

Cyrilla racemiflora. Anon. (*Gard. Mag.* 2,508, p. 757; 23/11/1901).—An illustration and description are given of this evergreen, which is known also as *Itea Cyrilla* and *Cyrilla caroliniana.* It is a widely distributed plant, being found in the Southern United States, the West Indies, and Brazil. It belongs to the Erica family and was first introduced in 1765. It may be grown in the open air in the mildest parts of these islands, or in a greenhouse or conservatory.—*W. G.*

Dahlia, Autumn Cuttings (*Rev. Hort.* p. 467; October 1901).—M. Chabanne, Superintendent of the Park Fête d'Or, Lyons, reports success by taking autumn cuttings and placing under glass. Well rooted

in twenty days, about the middle of December; the plants died down, having already formed strong tubers the size of a large nut, which gave plants rapidly in the spring. Though probably known to specialists already, this procedure is recommended for general adoption with novelties.—*C. T. D.*

Dahlias, Cactus, on Wired Walls. By Ch. Gr. (*Rev. Hort.* p. 491; November 1901).—Description of north wall so covered, permitting the better display of the flowers, which, in the bush form, are often hidden.

C. T. D.

Dahlias, New Types. By H. Dauthenay (*Rev. Hort.* pp. 494–5; November 1901).—Description of new sport *à collerette* ('Gloire de Nancy'), in which a circle of undulate white petals surrounds the central disc of yellow florets, large petals of deep red or purple, slightly margined with white, forming the outer corolla. Raised by M. Gerbeaux, Nancy.

C. T. D.

Date Palm, Culture of the. By Dr. Georg Schweinfurth (*Gartenflora*, pp. 506–517 and 541–546; 15/10/1901).—A comprehensive paper dealing with the cultivation of the Date Palm.

A similar account is given by Mr. W. T. Swingle in the *Year Book of the U.S. Dep. Agr.* 1900.—*J. P.*

Deciduous Trees in Tropical Primitive Forests. By G. Scheffler (*Not. Konig. Bot. Berlin*, No. 27, p. 139, Oct. 1901).—Under the title *Ueber die Beschaffenheit des Usambara-Urwaldes*, &c., the author gives an interesting series of natural-history notes on the habits, general characters, and especially the alternations of leaf-fall and leaf-flushes of trees in a region purely tropical. Usambara is in German East Africa, and only about five degrees south of the Equator. He divides the trees into three groups: (1) Those which hardly ever show signs of leaf-stripping, and are as nearly "evergreen" as a plant can be; (2) a series which during a certain period are distinctly prone to shed most of their leaves; and (3) a series which are entirely or nearly bare of leaves during a certain season of the year. The chief interest of the paper lies, in our opinion, less in the confirmation of the fact, already known to botanists, that so-called evergreen forests are not and never can be strictly such—though the author adds many definite cases to the list—than in the interesting little notes about such points as the period of flowering, the peculiarities of the wood, &c., of several strange and little-known trees. Such natural-history notes made on the spot are of great value and far too rare to be under-estimated.—*H. M. W.*

Dendrobium barbatulum, Lindl. (Cogniaux in *Dict. Icon. Orch.*, *Dendr.*, pl. 25; 5/1901).—A native of India, introduced in 1844. Flowers numerous, pure white.—*C. C. H.*

Dendrobium Hookerianum, Lindl. (L. Linden in *Lind.* xvi. pl. 730; 1/8/1901).—A rare and beautiful species introduced from Assam in 1868, though originally discovered by Sir Joseph Hooker in Sikkim in 1848. Flowers deep golden yellow, with two maroon blotches at base of lip, column white.—*C. C. H.*

Dendrobium Pierardi, Roxb. (Cogniaux in *Dict. Icon. Orch., Dendr.*, pl. 26; 5/1901).—Originally described by Roxburgh in 1823. Sepals and petals pale rose; lip pale primrose. A native of India.

C. C. H.

Dendrobium transparens, Wallich. (Cogniaux in *Dict. Icon. Orch., Dendr.*, pl. 27; 9/1901).—A native of the Himalayas, discovered in 1849. Flowers small, white tinted rose, with purple blotch at base of lip.—*C. C. H.*

Dianthus Hybrids. By Amelung (*Gartenflora*, p. 449, pl. 1,490; 1/9/1901).—A coloured plate of the parents and hybrids resulting from the crossing of *Dianthus Caryophyllus* ♂ (the Carnation) and *Dianthus chinensis* ♀ (Chinese Pink). The hybrids have the stiff stems of the Chinese Pink, and a faint odour of the Carnation. In colour and size of the flowers the hybrids are intermediate between the two parents.

J. P.

Diseæ, Monograph of (concluded). By R. Schlechter (*Engl. Bot. Jahrb.* xxxi. pp. 289-313; 10/12/1901).—Includes a few remaining species of the genus *Disa*, and the small genera *Schizodium* and *Brownleea*.—*A. B. R.*

Diseases of Red Cedar. By H. von Schenk (*U.S.A. Dep. Agr., Div. of Veg. Pathology, Bull.* 21; 1900. 7 plates and 3 figures).—The pamphlet describes the two diseases "white rot," caused by *Polyporus juniperus*, n. sp., and the "red rot," caused by *Polyporus carneus*, which attack the Red Cedar (*Juniperus virginiana*). The fungi and the injuries which they produce are described and illustrated.—*F. J. C.*

Dismal Swamp Region, Report on a Botanical Survey of the. By Thomas Kearney (*U.S.A. Dep. Agr., Div. Bot., U.S. Nat. Herb.*, vol. v. No. 6, 1901).—The climate of the region, giving temperature, illustrated by comparative tables of the thermometrical records at various stations, with data showing the latest and earliest frosts. Sunshine and cloudiness, together with atmospheric humidity, precipitation, and wind, are followed by a general summary of the above.

The geography and physiography of the region deals with general geography and prominent physiographic features of the beach, dunes, salt-marshes, plain, and swamps.

Geology, embracing soils of the salt-marshes, sand strand, and plain, with reference to the so-called "truck" soils, also general observations, are followed by descriptions and analysis of samples of same, taken at various stations. The wooded swamps are thoroughly dealt with in regard to their organic matter, acidity, clay content, texture, water, drainage, and soil analysis.

The plant covering of the region, its physiognomy and ecology, with formation classes of maritime, salt-marsh, and sand-strand formations, are well treated. Also adaptation to environment in the vegetation, with illustrations of the principal life forms. Modifications due to the mechanical action of the wind, protection against excessive transpiration and light, pollination, and dissemination of seeds are ably dealt with.

Non-hygrophile inland formations, consisting of forest, mixed forest and pine barrens, non-cultural cleared land, with the arboreous, shrubby and herbaceous associations, are given. Cultural formations, with descriptions of field crops, cultivated trees, and weeds, with their adaptation to environment.

Fresh water and marsh formations, open swamps, with adaptations to reduce transpiration, aëration, and environment, with the living forms of vegetation found therein. Aquatic vegetation is also briefly dealt with.

The phytogeographical affinities of the flora, with positions in life zones of N. America, the northern and southern limits of austro-riparian plants in the Dismal Swamp region, with their relationship to other floras, are ably set forth.

The agricultural products, truck crops, cereals, cotton, forage plants, peanuts, fruits, and other crops are shown, together with some notes on agricultural weeds.

An endeavour is made to ascertain the value or relation of native plant growth as an indication to the character of soils. The volume is concluded with a bibliography of the works dealing either directly or indirectly with the subject.—*E. F. H.*

Dorycnium, The Genus. By M. Rikli (*Engl. Bot. Jahrb.* xxxi. pp. 314–404, tt. vii.–x.; 10/12/1901).—An exhaustive systematic account of the genus, including details of observations on variability, and elaborate notes on geographical distribution.—*A. B. R.*

Dresden, Plants Specially Cultivated in. By M. René Sertin (*Jour. Soc. Nat. Hort. Fr.*, p. 942).—The methods of culture of *Azalea indica*, Camellias, and Rhododendrons for the flower markets of Germany and elsewhere are described. These seem to differ from the Belgian culture by the seemingly more hardy treatment and employment of less heat in the cultivation of the plants named above.

The larger proportion of plants are sorts adapted to forcing, and so the number of names of sorts most in cultivation seems to us limited.—*G. P.*

Drought, Combating (*Agr. Gaz. N.S.W.* p. 1,291; October 1901). A record of interesting investigations carried out by Messrs. W. M. Haye and W. G. Smith, of the Minnesota Agricultural Experimental Station, as to the best means of combating drought.—*A. W. S.*

Drying Plants, Some Methods of. By S. Rostowzew (*Flora*, vol. lxxxviii. 1901, pp. 473–8; 2 cuts).—Method 1. The plants are piled between sheets of absorbent cotton wool, each gummed by the edges to a sheet of silk-paper. These are piled to a height of 4–6 inches and pressed in Scheider's "lattice-plant press," and left in a dry place (such as a warm linen press) till desiccation, usually about two or three days. Method 2. A cylinder of perforated metal, say 20 inches high and 14 inches in diameter, is mounted on a tripod under which a lamp is burned. The surface of the cylinder is covered with linen attached to two opposite vertical rods provided with screws and butterfly nuts; over this the plants are placed between layers of filter paper, and a second envelope of linen

is fastened by the screws. These two methods preserve the natural colours of plants which blacken under ordinary herbarium methods.

M. H.

Echinacea atropurpurea. By Ch. Gr. (*Rev. Hort.* p. 466; October 1901).—A great improvement on *E. purpurea.* Though reputed hardy, suggests housing in winter. Described as an extremely elegant composite, as evidenced by specimen in 'Jardin Ecole de Soissons'; one metre high, very floriferous, and highly coloured.—*C. T. D.*

Echinops sphærocephalus nivalis (*Rev. Hort.* p. 395; September 1901).—Robust as the species, but with large pure white heads, seven centimetres and more in diameter. Recommended for planting with other robust compositæ, such as *Rudbeckia laciniata*, fl. pl., *Harpalium rigidum*, or *Silphium perfoliatum*, which flower simultaneously to good effect.—*C. T. D.*

Edgeworthia chrysantha, Flowering of. By Gustavo Mattei (*Bull. R. Soc. Tosc. Ort.* 12, p. 368; December 1901).—At the time of opening of flowers the plant is quite devoid of leaves, but these soon burst forth. Inflorescence consists of a pendulous head of flowers radiating from a common centre; the latter are about thirty in number and tubular. Eight stamens - four in the lower part of the tube, which mature and wither first; and four in the upper portion, which wither after the second period. The short limb of the perianth is coloured a fine golden-yellow, hence the specific name of the plant. The tube of the perianth emits an exquisite perfume during the whole of this period. After that the flowers gradually, in a centripetal direction, become arched and recurved towards the periphery of the inflorescence, while the perianth limb loses its golden colour, turning white; the odour vanishes, and the anthers of the upper whorl wither. The plant is closely allied to *Daphne.*

W. C. W.

Epidendrum fragrans, Swartz (Cogniaux in *Dict. Icon. Orch., Epid.*, pl. 15; 9/1901).—A native of Tropical America, one of the oldest Orchids in cultivation, having flowered at Kew in 1778. Flowers fragrant, yellowish white; lip lined purple. This plant is widely known as *E. cochleatum.*—*C. C. H.*

Eriopsis rutidobulbon, Hook. (L. Linden in *Lind.* xvi., pl. 739; 1/5/1901).—Introduced from Colombia in 1849. Flowers small, colour bronze and yellow; apex of lip white, spotted with purple.—*C. C. H.*

Erythroniums and their Culture. By G. B. Mallett (*Gard.* p. 380; 7/12/1901).—A description of numerous species and varieties, together with interesting cultural notes.—*E. T. C.*

Eschscholtzia californica (*Rev. Hort.* p. 443; October 1901).—Description of abnormal flower with stamens transformed into green grass-like leaves, bearing rudimentary anthers at tips, petals normal; plant so characterised throughout.—*C. T. D.*

Eucalypts, Hardy. Anon. (*Gard. Chron.* No. 782, p. 456, fig. 137, December 21, 1901).—Short descriptions are given of three species of *Eucalyptus* which have proved hardy in the grounds of Mr. Rashleigh, of Menabilly, Cornwall, who has now planted an acre of ground with thirty-seven varieties of this genus. The examples of *E. coccifera* vary from 50 to 70 feet in height.—*G. S. S.*

Eucalyptus leucoxylon. By Ed. André (*Rev. Hort.* pp. 500-1; November 1901).—Coloured plate, representing a very beautiful rose-pink inflorescence.—*C. T. D.*

Eucalyptus urnigera. By Sobatier (*Bol. R. Soc. Nac. Hort.* September 1901).—This plant is recommended for cultivation in districts where the winter is too severe for *Eucalyptus Globulus.* It resists a temperature of 10 degrees below zero.—*G. M.*

Experiment Stations, California. By Charles Howard Shinn (*Sunset*, vol. viii. p. 15, No. 1).—An account of the founding by the University of California of stations and sub-stations of experimental agriculture and of the good work being done in them under the presidency of Prof. Hilgard.—*M. L. H.*

Ferns, especially the Filmy Ferns of Jamaica. By Rev. David Paul, LL.D. (*Trans. Bot. Soc. Edin.* vol. xxii. pt. 1, 1901).—The author compares the area of Jamaica to that of Inverness-shire, and also the number of genera and species of Ferns in the whole British Islands, viz., 20 genera and 47 species, with the 45 genera and 473 species found in Jamaica. Thereafter his remarks are confined to the Filmy Ferns, of which *Hymenophyllum* has 28, and *Trichomanes* 25 species in the island. He recognises the difficulty of transporting healthy and vigorous plants for cultivation in this country, and affirms that "anyone who loves Ferns, and has means and leisure, would find that a holiday spent in these islands (Jamaica, Grenada, and St. Vincent) would repay him a thousandfold in the interest and pleasure he would experience at the time, and in a store of delightful recollections which would be a cherished possession to him all the days of his life."
M. C. C.

Ferns, Spermatozoa of. By R. Buller (*Bot. Zeit.* p. 260, No. 17; September 1901; *Annals of Botany*, 1900, pp. 543-582).—Series of interesting observations relating to attraction and repulsion of spermatozoids by exhibition of malic and other acids and salts, confirming recorded results and extending the data.—*C. T. D.*

Fertilisers, Analyses of (*U.S.A. St. Bd. Maine, Ann. Rep.* 1900, tables).—In the annual report of the Agricultural Experiment Station, pages 28 and 120, some interesting and valuable tables are given showing the results of analyses of samples of various fertilisers.—*V. J. M.*

Fertilisers, Commercial. Report of the West Virginia University Experiment Station on (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 and 1900, p. 221).—A valuable and explanatory report upon experiments with

various fertilisers, nutritive and stimulant, showing the composition and uses of such as the phosphoric acids, nitrogen, farm manure, &c. The bulletin well repays a careful perusal.—*V. J. M.*

Fertilising Field and Garden. By F. E. H. W. Krichauff, J.P., Corr. Memb. R.H.S.—In Tasmania, Apple and Pear orchards are frequently manured with 6 cwt. of bonemeal and 2 to 4 cwts. of kainit per acre.

For Peach orchards it is recommended to use 90 to 180 lb. of nitrate of soda, 320 to 840 lb. of phosphatic fertiliser, and 110 to 220 lb. of muriate or sulphate of potash per acre.

Olive pits, before being planted, should be cracked or placed for twenty-four hours in a solution of half a pound of caustic soda to a gallon of water.

In South Australia, at Upper Stuart, in 1892, an Apple tree belonging to Mr. Wescombe, forty years old, yielded 70 bushels of fruit.

For full-grown trees the author has used and recommends, in the case of Plums, 12 lb. of kainit, 4 lb. of Thomas phosphate, 2½ lb. of nitrate of soda; for Cherries, 14 lb. of kainit, 5 lb. of Thomas phosphate, and 1 lb. of nitrate of soda per tree each year.

In experiments on Raspberries by Mr. Ewers, 748 lb. of blood manure, 138 lb. of double superphosphate, and 265 lb. of muriate of potash gave 2,957 lb. fruit per acre, against 1,792 lb. from unmanured canes; 568 lb. of nitrate of soda, 144 lb. of double superphosphate, and 143 lb. of muriate of potash gave 2,598 lb.—*C. H. H.*

Figs in Australia. By C. T. Cole (*Qu. Agri. Journ.* ix., p. 4; October 1901).—The Smyrna Fig trees were imported some years ago with success. Artificial caprification is declared to be unnecessary. "May not the cause of figs falling off the trees before they reach maturity be improper kinds, unsuitable localities, and last, but not least, the absence of knowledge of proper and judicious pruning?"—*M. C. C.*

Flora of Africa, Contribution to the (xxii. continued). By A. Engler (*Engl. Bot. Jahrb.* xxx. pp. 289-445; tt. ix.-xxii.; 19/11/1901). The second and concluding part of the systematic account of the plants collected by W. Goetze at lakes Rukwa and Nyassa, and in the intervening mountainous country. Includes the Dicotyledonous division of Seed-plants, the different families elaborated by specialists. A large number of new forms are described, and, in addition to the plates, there are eight figures in the text.—*A. B. R.*

Flower Border for late Summer and Autumn (*Gard.* p. 368; 30/11/1901).—How to plant a flower border for colour effects in late summer and autumn, together with a design.—*E. T. C.*

Food of some Birds inhabiting an Orchard. By R. N. (*Gard. Chron.* No. 768, p. 197; September 14, 1901).—The writer watched various birds feeding in an orchard, and gives an account of what their food consisted of. Eleven different kinds of birds are reported on in this and a subsequent paper. The number of different kinds of insects eaten by the birds is surprising.—*G. S. S.*

Forage Plants, Native and Introduced. By J. H. Shepard, &c. (*U.S.A. Exp. Stn. S. Dakota Bull.* 69, January 1901; with cuts).—Including a large number of forage plants, but chiefly interesting on account of the chemical analysis of each species, which concludes each notice.—*M. C. C.*

Forestry, Tree-Planting Prize Competition. Anon. (*Agr. Jour. Cape G. H.* vol. xix. No. 6, pp. 387–403).—This paper gives the results of the competition held, in terms of the resolution of the Honourable the House of Assembly. The plants used in the formation of the new plantations at Diep Kloof, George, at an elevation of about 800 feet, were *Acacia mollissima* and *A. pycnantha*, and 90,000 trees, averaging 20 feet in height and 1,050 per acre, have been established. While at Schoonberg, George, on the opposite side of the Outeniyua Mountains, the plantation entered for competition is composed entirely of Blue Gum (*Eucalyptus Globulus*), with the exception of some 300 *E. diversicolor* planted in one block.—*R. N.*

Frost. By A. Buyssens (*Bull. Soc. Hort. Loiret*, tome vi. No. 13, p. 542; 1901).—The dangers of too rapid thawing described, and methods of protection suggested.—*E. A. B.*

Fruit Acclimatisation. By J. Plumer (*Gard. Mag.* 2,504, p. 692; 26/10/1901).—An interesting note of experiments carried out at a State experimental orchard in N. S. Wales, where upwards of 2,000 varieties of fruit trees have been planted. Apples, Pears, Plums, Apricots, are the chiefs objects of culture. The names of most of the varieties reported upon are familiar to us here as being the finest varieties in England. N. S. Wales may become one of the great fruit-growing countries when its capabilities are developed in this direction, and we may in time receive a regular supply of fruits from N. S. Wales orchards.—*W. G.*

Fruit, Conservation of. By X. (*Bull. R. Soc. Tosc. Ort.* 9, p. 286; Sept. 1901).—Fruit wrapped in tissue paper keeps well until complete maturity and preserves its proper taste and a beautiful a ppearance. Pears will keep well in fine shavings of fir and poplar-wood, but are inferior to those preserved in tissue paper. In barley-straw the fruit neither spots nor assumes a disagreeable taste, but loses its freshness and does not ripen so well as when the two preceding systems are employed. In hay it easily rots, becomes spotted, and assumes a strong odour of hay. Sawdust affords the worst results, as it causes the fruit to wither quickly. In finely chopped straw fruit keeps well; but it fades early and is apt to assume a musty odour. Dry leaves afford the same results. Fruit buried in sand keeps sound and ripens less quickly. This is the best method for preserving for a long time; it is preferable to wrap the fruits in tissue paper before covering them with sand.—*W. C. W.*

Fruit Diseases, and How to Treat Them. By L. C. Corbett (*U.S.A. Exp. Stn. W. Virginia Bull.* 66; February 1900; numerous cuts).—This bulletin is occupied by general remarks, as above. The diseases mentioned are: Bitter rot of Apples; brown spot of Apple leaves;

Apple scab; Apple rust; black spot of Peaches, produced by *Cladosporium carpophylum*; brown rot of Peaches; leaf curl of Peaches; Peach yellows, with flecks on the fruit, the true cause still unknown; leaf blight of Pear; Pear scab; shot-hole of Plums and Cherries; black knot of Cherry; black rot of Grape; downy mildew of Vine; orange rust of Raspberry; leaf spot of Strawberry. These are all well-known diseases, and the remedies suggested are spraying with the usual fungicides.—*M. C. C.*

Fruit-growing Industry in Cape Colony, A Review of. By C. Mayer (*Agr. Jour. Cape of G. H.*, vol. xix. No. 5, pp. 317–325).—The author compares the present position of fruit-culture in the Cape Colony with its position and economic importance of about fifteen years ago, showing that within the last decade considerable progress has been made, that in fact the foundation has been laid of an industry which, if properly and carefully handled, may in time have a great and beneficial influence on the agricultural development of the Colony, particularly the western portion, which climatically and in all other respects is pre-eminently suited to it. Annexure tables accompany the paper.—*R. N.*

Fruit Nomenclature. By E. Bartrum, D.D. (*Gard. Mag.* 2,511, p. 824; 14/12/1901). –The writer gives, in an interesting paper, his views as to the origin of the names of various kinds of Apples and Pears, such as the Red Quarrenden and Codlin Apples, the Barland and Nutmeg Pears; remarks on the merits of these fruits are given.—*W. G.*

Fruit, Oversea Carriage of (*Agr. Gaz. N.S.W.* p. 1,298; October 1901).—Fruit-growers who look to oversea markets for the disposal of their produce will watch with interest the experiments which are being conducted by the Victorian Department of Agriculture for the purpose of devising methods for keeping fruits fresh for prolonged periods. So far the experiments have been attended with results which point to the fact that the efforts of the Department will bring about some considerable measure of success. Reports on these experiments are given.—*A. W. S.*

Fruits, Classification of. By Georges Bellair (*Rev. Hort.* pp. 566–70; December 1901).—Descriptive list of Pears grown in France, given as excerpt from a general list published by the French Pomological Society.—*C. T. D.*

Fruit Trees, Benefits of Transplantation. By Gustave Courtois (*Rev. Hort.* pp. 504–6; November 1901).—Two woodcuts. Observations regarding fruit trees where lateral rooting is desired, owing to chalky or other unfavourable substrata.—*C. T. D.*

Fruit Trees, Manuring of. By L. Grandeau (*Rev. Hort.* pp. 525–6; November 1901).—Four woodcuts, showing effect on roots. Results of various experiments.—*C. T. D.*

Fruit Trees, Planting. By Alger Petts (*Gard.* p. 262; 19/10/1901).—A most valuable and exhaustive article, which is so condensed that the only abstract possible would be a reprint.—*E. T. C.*

Fruit Trees, Self-sterility in. By J. J. Willis (*Gard. Mag.* 2,511, p. 824; 14/12/1901).—This subject, so important to fruit-growers, is discussed in a lucid way, the deductions from which appear to be that certain varieties of fruit need the pollen of other varieties in order to make them fruitful, cross-fertilisation in fact, which the writer asserts is no longer a theory but an established practice in orchard culture. Wind and insect agency are the means by which this cross-fertilisation takes place in orchards, in the same way as manual pollination is effected in fruits under glass. The fruitfulness of the orchard therefore depends upon having a number of varieties in it that flower in succession.

W. G.

Fruit Trees, The Pruning of Newly Planted. By the Rev. G. H. Engleheart (*Gard.* p. 348; 23/11/1901).—A dissertation on the comparative advantages of "Pruning at the time of Planting" *versus* "Not Pruning."—*E. T. C.*

Fruit Trees, Unprofitable. By G. Wythes (*Gard. Chron.* No. 773, p. 288; October 19, 1901).—The reason of the condition of such trees, and the remedies, are given. Root pruning and judicious top pruning seem to be chief factors in the proper cultivation of such trees.

G. S. S.

Fruit Trees, Winter Washing of. Anon. (*Jour. Bd. Agr.* vol. viii. No. 2, September 1901, pp. 145-146).—This paper gives some useful practical hints and is here quoted *in extenso.* "A neglected orchard not only harbours all manner of insect enemies during the winter, which come out in the spring and commence their ravages in that particular orchard, but it forms a nursery or breeding ground from which other orchards are supplied with noxious insects.

"It is essential, therefore, that all such orchards should be treated in some way to stop the damage that is caused by the various insect pests they encourage.

"For this purpose a caustic or burning wash known as caustic alkali wash is most successful. This mixture serves a double function. It removes, by means of its caustic properties, all vegetal encumbrances, moss and lichen; and at the same time it causes all rough and decaying bark to fall off. A tree so treated soon assumes a more healthy appearance. By the removal of the moss and lichen from the trees, the favourite quarters of many hibernating insects are destroyed. Beneath the vegetal growths and rough bark found on fruit trees we find during the winter the woolly aphis, the apple-blossom weevil, the earwig, the codlin maggot, thrips, and numerous other small insects.

"The destruction of their winter quarters places these often serious pests in unfavourable circumstances, and they cease to increase in abnormal numbers. Scale insects, of which two at least are more or less harmful in this country, namely, the apple-bark louse or mussel scale, and the brown currant scale, may also be destroyed by caustic alkali wash.*

* For particulars of experiments with this wash on brown scale see *Jour. R. Hort. Soc.*, vol. xxiii. page 241 *et seq.*

"Not only are moss and lichens and the insects referred to above destroyed or stopped from excessive increase by this wash, but it acts also in another way by attacking the eggs of certain species. The extent of its action on the eggs has not, however, been fully determined. Groups of the eggs of the apple suckers (*Psylla mali*) treated with it were all killed, as also were those of the red spider on fruit—a species of *Bryobia*—and those of certain aphides. Spraying the wash over eggs recently laid had little effect on them, but, when the embryos were nearly mature, the majority of those of the insects mentioned above were destroyed.

"At present, therefore, the wash is mainly recommended for cleaning the trees in an orchard and thus destroying the shelter of various insects during the winter, and for killing certain hibernating pests themselves, as the codlin maggot, woolly aphis, and others. It certainly has no effect in the open on the ova of the winter moth, lackey moth, and those of certain plant lice.

"To prepare caustic alkali wash, first dissolve 1 lb. of commercial caustic soda in water, then 1 lb. of crude potash in water. When both have been dissolved mix the two well together, then add ¾ lb. of agricultural treacle, stir well, and add sufficient water to make up to ten gallons.

"The best time to spray the trees is about the middle of February, as some insects and mite eggs are then more liable to be affected than earlier in the winter, and it is then not too late to harm any developing buds.

"The wash has a burning effect on the hands; care must therefore be taken in employing it. Rubber gloves have been used by some people, but these, unless close fitting, allow the wash to run under the rubber, and more harm is done than usual. With ordinary care the sprayers need suffer little inconvenience.

"Every old or young orchard where moss and lichen and woolly aphis have a firm hold should undergo this treatment, which has a most beneficial effect, not only in clearing the trees of moss and rough bark, but indirectly in lessening insect attack."—*R. N.*

Fruits from Jamaica (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 4, p. 268).—An interesting account of the trade (chiefly in Bananas) between Jamaica and both the United States and England. It also advises the growth of Oranges, Pineapples, and Mangos, and holds out a brilliant prospect of the future of the trade.—*W. W.*

Fumigator for Small Orchard Trees (*U.S.A. Dept. Agr. Bull.* 133; *Exp. Stn. Work*, xviii. 1901; illustrated).—V. H. Lowe, of the New York State Station, has recently described a fumigator, designed for use with hydrocyanic gas against San José and other scale insects, the large tent or box covering for trees hitherto employed requiring too much labour and expense in manipulation. It consists of a light frame with three sides, the fourth being movable (to avoid *lifting* over trees), and a top, the whole covered outside with gas-tight material.

The cost varies from $13 to $18, and it can be carried and manipulated by two men.

Its chief advantages are: that its cubic contents are easily and

accurately computed; that it does not rest on the tree, thereby avoiding injury to buds and branches; and that fewer men are required for its manipulation than is usual with a tent large enough for trees of the same size.—*C. H. C.*

Fungi of Germinating Farm Seeds. By A. Lorrain Smith (*Trans. Brit. Myc. Soc.* 1900–1, with 1 pl.).—An enumeration of the species of moulds and other fungi which made their appearance in the saucers in which farm seeds were experimentally germinated. The conclusion arrived at is—"Unless the seeds have quite lost their vitality, the fungi do not really injure them or prevent the embryo sending out its rootlets, and clovers can grow when the outer coat is invisible owing to a thick crop of *Chætomium.*"—*M. C. C.*

Galeandra Batemani, Rolfe (L. Linden in *Lind.* xvi. pl. 729; 1/3/1901).—Introduced from Mexico in 1838. Sepals and petals tawny yellow; lip violet-purple, margined white, with yellow throat.—*C. C. H.*

Garden Truck, Freight and Increased Growth of. By E. Ward, jun., and E. Holmes, jun. (*U.S.A. Dep. Agr. Div. of Statistics, Bull.* No. 2, *Miscell. Series*).—A detailed account of the enormous growth during late years of the trade in garden produce between the Southern and Atlantic States and the big towns of the North-East, and between the gardens of the Mississippi Valley and the North-Western cities. There are careful tables giving the cost of production per acre of the various vegetable crops, under the heads of labour, seed, and fertilisation, and of the cost of carriage per car-load or crate from the various "trucking" districts to the great centres of distribution.

The writers bring out the far-sighted readiness with which the railway and steamship companies have met the wants of the growing trade, though it appears that, in most cases where refrigerator cars are used, these are the property of private companies who make their own contracts with the shippers and railway companies and themselves attend to the re-icing of the cars in transit.

Tables are also given showing the cost per package of distributing in various directions the immense fruit-crops of the Pacific States. The writers chronicle the fact that all along the Atlantic coast every hundred miles make a difference of one week in the time by which crops are ready for shipping.—*M. L. H.*

Gazania Hybrid 'Cyclope.' By Jules Rudolph (*Rev. Hort.* pp. 540–1; November 1901).—Raised by M. E. Thiébaut, 30 Place de la Madeleine, Paris. *G. splendens* ♀ × *G. nivea* ♂. Much larger flowers than either, with a large black spot on the base of each petal, forming a circle and suggesting the name. Recommended for sunny positions.
C. T. D.

Gnidia parvula. By A. H. Wolley Dod (*Journ. Bot.* 468, pp. 401–2; 12/1901).—Description of new species from the Cape Peninsula.
G. S. B.

Graft-hybrids of Cratægus monogyna and Mespilus germanica. By E. Koehne (*Gartenflora*, p. 628; 1/12/1901).—At

Bronvaux, near Metz, is an old Medlar grafted on a White Thorn. Immediately below the point of union of stock and scion Herr Simon-Louis observed a thorny branch springing from the White Thorn stock. In the form of the leaves which it bears, and the hairiness of its young twigs and flower-stalks, the branch resembles those of the Medlar. It differs, however, in having spines about 1 cm. long, and bears six to twelve flowers in clusters. The peduncles of the flowers are twice or three times as long as those of the Medlar, the calyx only half as long as in the latter plant. The number of stamens is from fifteen to twenty (not thirty or forty as in *Mespilus*), and the flower possesses only one to three stigmas instead of five. The fruit resembles a Medlar, but is much smaller—only 12 mm. long and 17 mm. broad.

This form has been propagated by grafts, and named *Cratægomespilus Dardari* by Simon-Louis (=*Cratægus Oxyacantha* × *Mespilus germanica* f. Dardari).

Close to this Dardari-branch is found a second branch, which, in the form of its leaves, the possession of spines, the inflorescence, and size of its fruit, greatly resembles the White Thorn. The leaves are, however, hairy like those of the Medlar and the Dardari-branch, and the fruit is a leathery-brown colour. This form has been named Cratægomespilus 'Jules d'Asnières' Simon-Louis (=*Cratægus Oxyacantha* × *Mespilus germanica* f. Asnières). Both these graft hybrids are quite different from *Cratægus grandiflora*.—*J. P.*

Grafting (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 *and* 1900, p. 234).—A short illustrated article on grafting, describing carefully various methods of grafting, *e.g.* scion, cleft graft, whip graft. Also notes upon waxing and waxed string, as used for grafting.—*V. J. M.*

Grammatophyllum Ellisii, Lindl. (Cogniaux in *Dict. Icon. Orch., Gram.*, pl. 2; 11/1901).—Introduced in 1859 from Madagascar. Flowers greenish-yellow, shaded copper colour; lip white, striped purple.
C. C. H.

Grasses and Clovers worthy of Cultivation in South Dakota. By T. A. Williams (*U.S.A. Exp. Stn. North Dakota*, 1896, with cuts).—Simply a description of a few well-known Grasses and Clovers, in general cultivation in Europe.—*M.C.C.*

Grasses, Ornamental. By John Denman (*Garden*, No. 1,575, p. 60; 25/1/1902).—The writer comments upon the prominence to which Grasses for ornamental purposes have lately attained, their usefulness for bouquets, when dried for winter decoration, &c. A selection of Grasses suitable for the background of a border, for grouping, or for an edging for borders is given, and full cultural directions are also supplied.—*E. T. C.*

Greenhouse, Utilising in Summer (*U.S.A. Dept. Agr. Bull.* 133; *Exp. Stn. Work*, xviii. 1901; illustrated).—Experiments were tried in growing Tomatos, Egg plants, 'Peppers,' Musk Melons, &c., during the summer months, when forcing-houses usually lie idle. The

result was found to be profitable, especially during such a bad season as that of 1897, when outdoor crops were unsatisfactory.—*C. H. C.*

Gymnosporangium gracile, Pat. Champignons Algéro-Tunisiens nouveaux, par N. Patouillard (*Bull. Soc. Myc. de Fr.* xviii., 1902).—Description of a new species of *Gymnosporangium* on *Juniperus Oxycedrus*, with the æcidium form on the leaves of *Pyrus longipes*. Similar to the well-known *Gymnosporangium clavariiforme* found in Britain on the common Juniper.—*M. C. C.*

Hedges, Plants for. By J. C. (*Gard.* p. 233, 5/10/1901 ; p. 246, 12/10/1901).—The writer gives valuable information upon the most suitable plants for making hedges, including many (e.g., *Osmanthus ilicifolius*) which few people have ever thought of using for the purpose. He also gives directions as to the way to treat them.—*E. T. C.*

Heliophila tabularis. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 397 ; 12/1901).—Description of new species from the Cape Peninsula. *G. S. B.*

Hellebores or Lenten Roses. By Alger Petts (*Gard. Mag.* 2,507, p. 739 ; 16/11/1901).—Useful notes on the cultivation of various species and varieties of *Helleborus*. Details are given of the soil and position suitable for the various kinds, as well as on transplanting and propagation. A descriptive list of the best varieties is also given.—*W. G.*

Hermannia rudis. By N. E. Brown (*Journ. Bot.* 468, p. 398 ; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Heurnia primulina, N. E. Br. By A. Berger (*Die Gart.* p. 149 ; 28/12/01).—Mentioned by the author as a pearl among Succulents, and specially the Stapelias, being also much hardier, robust, and floriferous. The flowers are cream-colour, tinged velvety brown.—*G. R.*

Hidalgoa Wercklei (Climbing Dahlia). By J. Foussat (*Rev. Hort.* pp. 521–4 ; November 1901).—Six illustrations. Origin, description, and culture. Not hardy.—*C. T. D.*

Hoheria populnea. Anon. (*Gard. Chron.* No. 778, p. 374, sup. plate, November 23, 1901).—A very handsome New Zealand shrub, belonging to the order *Malvaceæ*. It produces a profusion of pure white flowers in the early winter months, and has handsome foliage; would probably be found to be hardy in the South of England.—*G. S. S.*

Horned Poppy. Notes on the British Distribution of *Glaucium flavum*, **the Horned Poppy.** By Alex. Somerville, B.Sc., F.L.S. (*Trans. Bot. Soc. Edin.* vol. xxii. pt. 1, 1901).—This is a brief topographical record of the occurrence of the Horned Poppy on the British coasts.—*M. C. C.*

Horse-chestnut Parasite. 'Le *Schizophyllum commune*, parasite du Marronier d'Inde.' By M. F. Guéguen (*Bull. Myc. Soc. Fr.* xvii.

p. 283, 1901; with cuts).—This Agaric is shown to be a parasite of the Horse-chestnut in parts of France, although it is extremely rare in Britain, and generally on imported wood. In the above account the manner of attack, its ravages, and the results of inoculation are detailed, with suggestions as to the causes and remedies.—*M. C. C.*

Horticultural Exhibition in Vienna, First Imperial (*Wien. Ill. Gart. Zeit.* p. 369).—This exhibition, duly heralded in the October number of the same journal, seems, from the full report in the November number, to have been an unqualified success. It was held in the park of his Highness the Prince of Schwarzenberg, at Renweg, on October 2-8, and was visited by his Imperial and Royal Majesty the Emperor, who offered a prize of a silver wine service for six persons. Remarkable groups of plants were Cycads, Palms, with stove and greenhouse plants, Orchids, Bromelias, &c., from Prince Schwarzenberg's garden. A remarkable collection of Nepenthes, Sarracenias, Droseras, Pinguiculas and other insectivorous plants from the Imperial Gardens at Schönbrunn; Orchids from Messrs. Dittrich & Donau, near Prague; hardy plants; Alpines from the Royal Gardens at Innspruck and Belvidere collectively; Roses, cut flowers, fruit and fruit trees, vegetables, garden designs, garden implements, &c., show the exhibition to have been on a large and comprehensive scale. About 40,000 visitors passed through the turnstiles.—*G. P.*

Horticultural Industry, A New. By H. T. Wright (*Gard. Mag.* 2,513, p. 858; 28/12/1901).—A description of the methods practised in some of the large market nurseries near London in retarding bulbs and various other plants by refrigeration—a subject of much interest and importance, not only to market growers, but to gardeners generally. The account is illustrated by examples from the Turnford Hall nurseries, where these methods are carried out on a large scale.—*W. G.*

Hotbeds, Sowing on. By H. Dauthenay (*Rev. Hort.* pp. 406-8; September 1901).—General instructions for sowing and subsequent treatment.—*C. T. D.*

Hügel, Carl Alexander von, Memorial (*Wien. Ill. Gart. Zeit.* p. 380).—The unveiling of the memorial statue in the Heitzinger Cottage Park by the President of the Vienna Horticultural Society, H. E. Count Johan von Harrach, took place on October 8, 1901. This memorial is a token of the horticultural work of this eminent soldier, diplomatist, and statesman. During his travels in India, Thibet, and the Cape, which lasted six years, dating from 1830, he seems to have sent to his grower, Herr Johann Heller, a large number of new plants, amongst others *Rhododendron nilagiricum*, *Lilium giganteum*, many Banksias, Ferns, and other plants—131 sorts of Proteaceae passing later to the Schönbrunn collection.

His exertions led to the founding of the Vienna Horticultural Society, of which he was the first president. He died in Brussels in 1870.—*G. P.*

Hyères, Horticulture at. By Ch. Flahault (*Bull. Soc. Bot. France*, xlvi. 1899; Sess. Extraord. à Hyères, Mai 1899 (published November

1901), pp. clix–cxcviii).—An interesting account of the public and the principal private gardens at Hyères and the neighbourhood, and of the special features of their horticulture.—*A. W. B.*

Hypodiscus capitatus and H. Dodii. By M. T. Masters (*Journ. Bot.* 468, p. 402; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Improvement of Plants. By Prof. G. H. Powell, Washington, D.C. (*Amer. Gard.* xxii. pp. 668, 682, 717; 28/9/1901; 5/10/1901; 19/10/1901).—A series of interesting articles laying special stress on the variation of individual buds of the same tree, which, though perhaps slight at first, may be increased into a valuable variety by the cumulative selection of several generations of buds in a certain direction.

This process is naturally distinct both from ordinary sexual reproduction, and also from the selection of decided sports in bud variation.
C. C. H.

India-rubber in Rhodesia. By Major Colin Harding (*Bull. Bot. Dep. Trinidad*, No. 31, p. 387; October 1901).—Extract from the *India-rubber and Guttapercha Trades Journal*. An account of three indigenous plants productive of rubber: (1) *Landolphia florida*, (2) *Funtumia elastica*, (3) *Capodinus lanceolatus*.—*E. A. B.*

Insects, Noxious, in Maryland. Miscellaneous entomological notes by Prof. W. G. Johnson (*U.S.A. Hort. Soc. Maryland*, vol. ii. 1899, with figs.).—Notes are given on:—

Strawberry insect (*Myodocha serripes*); the whole crop destroyed by this insect.

Apple-trees suffering from the depredations of the locust leaf-beetle (*Odontota dorsalis*) defoliating the trees.

Pear and Plum. The young buds were seriously damaged by the tarnished plant bug (*Lygus pratensis*). Spraying with kerosene and water had been adopted.

Pear Psylla. Unusually abundant in large Pear orchards; 400 dwarfed Duchesse Pear trees so seriously damaged that they will be cut down. The pest is *Psylla pyricola*.

Currant worm (*Pteronus* (*Nematus*) *ribesii*). Attacked Currant and Gooseberry early in May and was a serious pest throughout the State.

Plum curculio (*Conotrachelus nenuphar*) unusually abundant, the principal injury being to the Peach crop, and some injury to the Apple. (Fig. 12.)

Strawberry weevil (*Anthonomus signatus*). Appeared in quite destructive numbers. The last general outbreak was in 1896. No satisfactory remedy is known.

Grape vine flea beetle (*Haltica chalybea*) very abundant on Grape vines in the upper counties. The main injury was done to the leaves, and not to the unfolding buds.

Hessian fly (*Cecidomyia destructor*). Conspicuously abundant in the early-sown Wheat.

Tussock moth (*Notolophus* (*Orgyia*) *leucostigma*). Very destructive to shade trees of all kinds. Every leaf was taken from some trees.

Elm-tree beetle (*Galerucella xanthomelæna*) did the usual amount of damage to the English Elm throughout the State.

Walnut-tree caterpillar (*Datana integerrima*) has almost defoliated every black Walnut tree in the north part of the State. Also found on Hickory, Apple, and Quince.

Melon plant louse (*Aphis gossypii*) has ruined many hundred acres of Melons.

San José scale (*Aspidiotus perniciosus*) has been most conspicuous; 68 new localities visited during the past year.

Oyster-shell scale (*Mytilaspis pomorum*) has been very destructive to Lilac.

The report also states that the Harlequin Cabbage bug (*Murgantia histrionica*), which did so much damage last season, has been almost absent.

The Asparagus beetle (*Crioceris asparagi*) has also been absent. And the Colorado Potato beetle has not been abundant.—*M. C. C.*

Insecticide Experiments, Some. By C. L. Marlatt (*Bull.* No. 30, *N.S.*, *U.S. Dep. Agr.*, *Div. Ent.*, pp. 33–39; two plates).—The experiments were made in the spring and early summer of 1900, and were designed to test the effect of various substances, chiefly against the San José scale insect. They included (1) crude petroleum; (2) refined kerosene; (3) lime, sulphur, and salt wash; (4) hot water; (5) Bordeaux wash and kerosene emulsion; and (6) kerosene and lime emulsion.

Crude and Refined Petroleum.—A series of Plum, Apple, and Pear trees were sprayed March 22 with crude petroleum (43 degrees Baumé), the applications being made thoroughly enough to completely wet the bark. The Plum trees were thickly infested with *Diaspis pentagona* and the Pear trees with the San José scale. Some of these trees had been pruned back heavily, and others were straggling trees ten or twelve feet in height. The application was made between 2 and 3 P.M. on a bright, dry day. At the same time a block of trees was sprayed with kerosene or refined petroleum. The weather continued fair and dry for four days, and there was no rainfall of any amount prior to April 11. After the second day the kerosene had very largely evaporated, the treated trees showing only a very light discoloration. Trees treated with crude oil, on the other hand, were still very wet and oily-looking. The full-grown female scales of *Diaspis pentagona* were thoroughly soaked and were permanently preserved, apparently, in the oil and had scarcely changed colour and were not drying up. After six days a slight change in the coloration of the female scale insects began to be observed, the colour slightly altering from light lemon to light orange. This change in coloration is a certain indication of the death and gradual drying up of scale insects, which usually change from lemon to orange, and finally to brown or black in the different states of drying after being killed by an insecticide. Three weeks after the application the trees treated with the crude oil were distinctly greasy in appearance and blackened by the oil. Trees sprayed by the pure kerosene gave no indication of having

been treated at this time, the oil having entirely evaporated. Curiously enough, the grass growing about the trees treated with these oils seemed to be more affected by the refined than the crude oil, being somewhat yellowed. This grass had been sprayed pretty heavily with the oil to see what result would follow. Two weeks later—namely, five weeks after the application—the bark of the trees treated with the crude oil was still dark and distinctly oily. All the trees treated with oil were leafing out and blooming just as freely and fully as untreated trees. The grass, which had shown yellowing at the outset, had entirely recovered and was apparently uninjured, seeming to indicate, at any rate, that grass will stand a considerable application with both crude petroleum and the refined oil without being killed. This fact is interesting in connection with the use of this substance against white grubs on lawns. It is further stated that the trees treated were not in any way injured, and the effect on the scale was all that could be desired.

Lime, Sulphur, and Salt Wash.—The action of this mixture is somewhat affected by climatic conditions. The formula used was —

Lime	30 lb.
Sulphur	20 lb.
Salt	15 lb.
Water	60 gallons

This mixture was steam-boiled altogether in barrels about four hours, and applied March 23 and repeated March 24. The hot liquid was taken immediately from the barrels at almost a boiling temperature and sprayed at once on the trees. The results were less satisfactory than that obtained from the crude and refined kerosene.

Kerosene-lime Emulsion.—The formula given is as follows:—

Fresh lime	4 lb.
Water	5 gallons
Kerosene	1 gallon

"Slack the lime slowly with small quantities of water in order to get a creamy solution. When thoroughly slacked dilute to 5 gallons, add 1 gallon of kerosene, and churn until emulsified (one or two minutes). This mixture was applied April 14 to a Peach tree badly infested with *Diaspis pentagona*, and to several Pear, Quince, Apple, and Peach trees not infested with scale insects, the application to the latter being made more particularly to determine the effect of the wash on different kinds of trees." . . . The effect of this wash on trees was not unfavourable, no injury being noted. The scale insects on the only tree subjected to the wash were, for the most part, dead or dying by April 17, the wash holding well and still coating the trees uniformly. This lime emulsion is worthy of a more extended trial, and it is hoped that others who have opportunity to test its effect on various scale insects will undertake experiments with it.

Whitewash.—"At the suggestion of Dr. Howard, with the idea of determining the effect of the lime in several limewashes used, a good-sized Plum tree thickly infested with *Diaspis pentagona* was subjected on the same date as the last two experiments to a thorough spraying with a strong whitewash, prepared by slaking 2 lb. of stone lime in a

gallon of water. The application left a thick coat of whitewash on the tree, entirely obscuring the bark and leaving the plant snow-white. At the time of treatment the buds had not started. This limewash held very well except that it cracked and scaled off a little in spots, due to the action of the wind. In the main, however, the bark of the tree remained snow-white and thickly covered for three or four weeks, in fact at the end of the summer the lime still adhered to some slight extent. The tree came into bloom and leaf later on without any checking from the application. The adult female scales were not affected, apparently, at all by this application, rather to our disappointment, but it was still hoped that the lime-coating would remain and prevent the young scales from settling on the bark. The young of this species, however, appeared very late in the spring and, unfortunately, before that time the lime had so cracked and scaled off in spots that little benefit was gained from its presence, and the second brood at least of this species again completely covered the tree." This pure limewash appears, therefore, to be of little value against the scale insects belonging to the sub-family *Diaspinæ*, which includes our common "Mussel scale" (*Mytilaspis pomorum*) and the Oyster-shell Bark-louse (*Aspidiotus ostreæformis*), both of which are injurious to fruit trees in this country. (See *R.H.S. Journal*, vol. xxiii. p. 219 *et seq.*)

The experiments with the other substances did not produce very satisfactory results also.—*R. N.*

Insecticides, Experiments upon Potatos with. By Chas. D. Woods (*U.S.A. St. Bd. Maine, Ann. Rep.* 1900, table).—In the annual report of the Maine Agricultural Experiment Station, page 171, is a valuable report of the results of various experiments with such insecticides as Paris green, arsenate of lead, &c. Careful field notes and practical directions are given.—*V. J. M.*

Insect Enemies of the Spruce in the North-East. By A. D. Hopkins (*U.S.A. Dep. Agr. Div. Ent. Bull.* 28 (new series), 1901; 48 pages, with 16 plates).—The investigations undertaken to determine the cause or causes of a prevailing unhealthy condition of the Spruce in certain sections of the forests of Maine, New Hampshire, and Vermont are given in this pamphlet. A large amount of dead Spruce was observed throughout the area traversed. The dead trees were not confined to any particular soil, altitude, or exposure, but were found wherever the diameter of the trees was over twelve inches. The first indication of the unhealthiness of a tree is the appearance of a pale tint in the leaves of the upper branches, or tops: these soon fall, and a slight jar or wind will cause a shower of the needles to fall. There are two causes of death, the work of beetles in the middle bark, and the presence of fungi in the bark and wood. The chief offender is a beetle belonging to the family *Scolytidæ* (*Dendroctonus piceaperda*). The life-history of this insect is given with full details, illustrated with some very good plates copied from photographs by one of the half-tone processes. This insect is attacked by two parasites; one, a small parasitic four-winged fly, *Bracon simplex*, which deposits its eggs in the larvæ; and a beetle

belonging to the family *Cleridæ* (*Thanasimus nubilus*), which preys upon the beetles. Among birds the chief enemies of this pest are various kinds of woodpeckers. Two other beetles belonging to the family *Scolytidæ* also assist in a measure in causing the death of Spruces, and there are various other insects that to some extent participate in the work of destruction, but only in a slight degree. Various remedies and methods of prevention are discussed. The most useful appear to be regulating the winter cutting, so that as many infested trees as possible may be felled, and placing the logs in the water before June 1; and in summer by removing the bark from the felled timber as soon as it is cut, and girdling early in June a number of trees where logging will be carried on during the following summer or winter. The girdled trees should be felled and barked, or put in water before the next June.—*G. S. S.*

Insect Pests in U.S.A. (*Amer. Gard.* xxii. pp. 730, 762, 810, 828; 26/10/1901, *et seq.*).—A series of articles containing the synopsis of the horticultural laws, rules, and regulations of the States, Territories, &c., of the United States, issued by the New York State Department of Agriculture. These have special reference to the inspection, certification, and transportation of nursery stock, and in many cases seem to us to be very stringent, though doubtless of great national value.—*C. C. H.*

Insects, Control over. By H. Maxwell Lefroy (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 4, p. 318).—Suggestions of the utmost value for establishing such a control over the entry of plants &c. into any country as to prevent the introduction of insect pests. Some central authority, it is suggested, should have power for the general welfare of (1) destroying all plants &c. found to be infested with disease; (2) of prohibiting importation of plants from specified places known to be suffering from diseases; (3) of inspecting nurseries and issuing or refusing certificates of plant health, without which no distributing should be permitted; (4) of inspecting and of either fumigating or imposing quarantine on suspected plants. It also gives most useful advice as to preventive methods and remedial measures, not omitting the protection of useful birds, lizards, toads, bats, &c., and suggests the introduction of certain new forms of animal, bird, and insect life to the West Indies. It is a most valuable and exhaustive essay, and should be studied by all who are interested in reducing or excluding insect pests.—*W. W.*

Insects Injurious to Strawberries. By L. Bruner (*U.S.A. St. Bd., Nebraska*, 1901, pp. 49–100).—The bibliography of the subject is given, a list of ninety-seven insects attacking the Strawberry in North America, and full notes on the Strawberry Leaf-roller (*Phoxopteris comptana*, Frol.), Strawberry Root-louse (*Aphis forbesi*, Weed), Strawberry Saw-flies (*Emphytus maculatus* and *Monostegia ignota*), Strawberry Weevil (*Anthonomus signatus*), Strawberry Crown-borer (*Tyloderma fragariæ*), and May Beetles (*Lachnosterna*).—*F. J. C.*

Insects, Notes on, in Maine during 1899. By F. L. Harvey (*U.S.A. St. Bd. Maine, Ann. Rep.* 1900. *In the Report of Agricultural*

Experiment Station, p. 81, tables).—A report on the pests of the horticulturists in this State, describing several, such as *Anosia plexippus*, *Ips fasciatus*, and *Tmetocera ocellana*.—*V. J. M.*

Insects, Three injurious (*U.S.A. Exp. Stn. South Dakota*, April 1896, with cuts).—This bulletin contains descriptions, with figures, of three injurious insects: The Box Elder twig-gall moth (*Proteopteryx spoliana*); the web-spinning saw-fly of Plums and Cherries (*Lyda spoliana*, or, as since named by Marriott, *Lyda rufipes*); and the Wheat-stem maggot (*Meromyza Americana*). With some methods of treatment.
M. C. C.

Iresine (Achyranthes) variegated 'Panache de Bailly.' By H. Dauthenay (*Rev. Hort.* p. 474; October 1901).—An improvement on *I. aureo-reticulata*; foliage golden yellow, somewhat greenish when mature. Raised from dimorphic plant of *I. Herbstii brilliantissime* fixed by cutting.—*C. T. D.*

Iris Ewbankiana. By M. Micheli (*Rev. Hort.* pp. 398–9; September 1901).—Two woodcuts; sub-genus *Oncocyclus* (described in *Gard. Chron.* 1901, i. p. 397).—*C. T. D.*

Irises, A new race of hybrid alpine. By W. J. Caparne (*Gard. Chron.* No. 779, p. 397, sup. plate, November 30, 1901).—Descriptions of these Irises are given, with their colours, and directions as to the best methods of cultivation.—*G. S. S.*

Irrigation. By E. J. Wickson (*U.S.A. Dep. Agr. Farmers' Bull.* No. 138, eighteen figs.).—The introduction insists upon the value of irrigation, even in districts where the natural moisture seems ample. It must be remembered that water is not only a necessity in itself, but the means by which plants are enabled to make full use of the other foods supplied to them. The writer then proceeds to give clear and detailed descriptions, assisted by figures of various methods of irrigation, suitable to different purposes and sources of supply, and which can all be carried out without expert advice, without expensive machinery, and without specialised labour.

He authoritatively condemns sub-irrigation by pipes, as distinguished from "underflow irrigation," which consists merely in imitating or reinforcing the natural drainage of water through the subsoil, and he suggests all the considerations to be taken into account before deciding on any particular form of irrigation work.—*M. L. H.*

Ivy and its Uses. By Wm. Chrystal (*Garden*, No. 1,576, p. 71; 1/2/1902).—This article points out that, although appreciated as an ornamental plant, Ivy is not nearly so much used or in such a variety of ways, especially in small gardens, as it might be. Some of the positions recommended for its extended planting are under trees where practically nothing else will grow, to clothe large pots, tubs, vases, &c., by the sides of ornamental water, and to form a screen to protect tender plants.
E. T. C.

Japanese Dwarf Trees. By M. Tsumura (*Jour. Hort.* p. 536; December 12).—Abstract of a lecture before the Japan Society giving some account of the rearing of these.—*C. W. D.*

Juglans cordiformis. By W. Bean (*Gard. Chron.* No. 773, p. 292; October 19, 1901).—This Walnut, a Japanese species originally described by Maximowicz in 1873, is being sent out by some Continental nurserymen and promises to be a very handsome tree. Its leaves are often over 2 feet long, and the male catkins are 12 or more inches in length. It is said to be likely to thrive in this country.—*G. S. S.*

Juniper Disease. By A. v. Jaczewski (*Zeit. f. Pflanz.* xi. pp. 203 207, 7 figures; 11/1901). -Description of mode of attack and the characters of a fungus parasitic on Juniper, abundant in the Smolensk district of Russia. It agrees with *Coryneum juniperinum*, Ellis, of North America, but in agreement with Karsten, who found it in Finland, Jaczewski places it in the genus *Exosporium*, under the name *Ex. juniperinum* (Ellis) Jacz.—*W. G. S.*

Kiefer Pear, past, present, and future. By J. S. Harris (*U.S.A. Hort. Soc. Maryland*, 1898).—Previous to the introduction of the Kiefer Pear, the Bartlett was the popular Pear. The former has materially improved in the Maryland climate, and it is now a favourite. Instructions are then given as to cultivation. It is the general opinion that less than one fifth of the Kiefer Pear trees now planted in the State have reached the age for full crops. In this lie the hopes for the future, since the Kiefer Pear has "attained to a dangerous popularity." *M. C. C.*

Kochia scoparia. Anon. (*Gard. Chron.* No. 777, p. 359, fig. 110; November 16, 1901).—A curious plant belonging to the order *Chenopodiaceæ*. Forms a very compact bush. In autumn its leaves turn a reddish-crimson colour, and it is then a very striking plant.—*G. S. S.*

Lælia (Cattleya) × exoniensis (Leonard Barron in *Amer. Gard.* xxii. p. 861, fig. 176; 21/12/1901).—One of Mr. Dominy's fine old hybrids obtained in Messrs. Veitch's nurseries at Exeter in 1863. Sepals and petals delicate blush, lip velvety rose-purple with white margin, throat golden-orange veined purple. This hybrid is of rather doubtful parentage; it was at first thought to be from *Cattleya Mossiæ* ♀ and *Lælia purpurata* ♂. Mr. Barron thinks that it is from *L. crispa* and *L. purpurata*; but Mr. Rolfe (in *Orch. Rev.* 1893, p. 5; 1896, p. 258) says it is certainly a *Lælio-Cattleya*, and from *L. crispa* and either *C. Mossiæ* or *C. labiata*. Judging from the excellent photograph in *Amer. Gard.*, I think there is little doubt that it is from *L. crispa* and *C. Mossiæ*.—*C. C. H.*

Lælia flava aurantiaca (Cogniaux in *Dict. Icon. Orch.*, *Lælia*, pl. 19A; 5/1901).—Flowers larger than type, bright orange yellow. *L. Cowani*, introduced from Brazil in 1898 by Messrs. Cowan, of Liverpool, is probably synonymous with this.—*C. C. H.*

Lælia × Lindleyana, Veitch (L. Linden in *Lind.* xvi. pl. 742; 1/7/1901).—A supposed natural hybrid between *Brassavola tuberculata* and *Cattleya intermedia*; if this proves correct it should be known as *Brasso-Cattleya* × *Lindleyana*. Discovered by Jean Linden in S. Caterina, Brazil, in 1857, and has since been found at Bahia. Flowers small, white; lip with purple rose apex and light yellow throat.—*C. C. H.*

Lælia rubescens, Lindl. (Cogniaux in *Dict. Icon. Orch.*, *Lælia*, pl. 20; 5/1901).—A native of Central America, introduced in 1889. This is a variable species, with no fewer than eleven synonyms.—*C. C. H.*

Lælio-Cattleya × Alberti, L. Lind. (L. Linden in *Lind.* xvi. pl. 723; 1/1/1901).—A hybrid raised by Messrs. Linden, of Brussels, in 1900, and said to be from *L. purpurata* and *C. velutina*, but there is not the slightest trace of the peculiar form and colour of the latter. A careful comparison with the hybrid *L.-C.* × *intermedio-flava* suggests to me that *L. flava* was probably the other parent, and not *C. velutina*. In that case the hybrid should be called *L.* × *Alberti*. Flowers medium, sepals and petals creamy-citron, lip white suffused with rosy purple. Very distinct and pretty.—*C. C. H.*

Lælio-Cattleya × Canhamiana alba (Cogniaux in *Dict. Icon. Orch.*, *Cattleya* hyb., pl. 18; 11/1901).—A beautiful hybrid, which appeared in 1894, between *L. purpurata* and *C. Mossiæ*. Sepals and petals pure white; lip rich crimson-purple, margined white, with yellow base. It was raised by Messrs. J. Veitch & Sons.—*C. C. H.*

Lælio-Cattleya × Hérode, Peeters (Cogniaux in *Dict. Icon. Orch. L.-C.* hyb., pl. 17; 3/1901).—A garden hybrid raised between two natural hybrids, *Cattleya* × *O'Brieniana* ♀ × *Lælio-Cattleya* × *elegans Turneri* ♂, and first flowered by M. Peeters, of Brussels, in 1900. Four distinct species are apparently concerned in the pedigree of this hybrid, viz.:—*C. Loddigesii*, *C. dolosa*, *L. purpurata*, *C. Leopoldi*; and their influence is shown in the same order, *C. Loddigesii* being the most apparent and *C. Leopoldi* the least.—*C. C. H.*

Lælio-Cattleya × 'Impératrice de Russie' (Cogniaux in *Dict. Icon. Orch.*, *L.-C.* hyb., pl. 18; 9/1901).—A hybrid obtained by M. Maron, of Brunoy, out of *C. Mendelii* by *L. Digbyana*, first flowered in 1899. Flowers pale rose; lip tinted and lined with yellow, and prettily fringed.—*C. C. H.*

Lælio-Cattleya × Pringiersi, L. Lind. (L. Linden in *Lind.* xvi. pl. 750; 5/9/1901).—A derivative hybrid between *L. purpurata* and *L.-C.* × *elegans* (the latter parent being itself a natural hybrid between *L. purpurata* and *C. Leopoldi*), raised by Messrs. Linden, of Brussels, in 1901. The three-lobed lip of the grandparent, *C. Leopoldi*, is still inherited, though modified, and the flowering pseudo-bulb bears two leaves as in that ancestor (but one long and one short); for the rest the hybrid would pass as a rich dark form of *L. purpurata*.—*C. C. H.*

Leaf-arrangement in Cellular Plants, The Mechanical Theory of. By Dr. H. Seckt (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 257–278, plates 1 and 2).—The author describes and figures the leaf-origin in various Mosses and *Florideæ.* The paper contains many references to the literature of the subject; in general his position seems to be in favour of the mechanical theory as opposed to the views of Kny, Berthold, and Rosenvinge.—*G. C. S.-E.*

Leaf, Unfolding of the. By G. Hinze (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 224–256, plate 1).—The paper contains exact details of the unfolding of the leaf in a great many special cases. Occasionally the vernation differs even in the same bud. As an example of the method *Castanea vesca* may be described. The apex of the whole shoot bends sideways like a bow; the straightening follows soon after, when the growth becomes rapid. The downward curvature of the leaf is caused almost wholly by the bending of the stalk. The blade opens basifugally, and becomes strongly arched. The transverse folds of the leaf vanish when the lamina becomes upright.—*G. F. S.-E.*

Libocedrus macrolepis. By M. T. M. (*Gard. Chron.* No. 783, p. 467, December 28, 1901).—This genus is very closely allied to *Thuya,* and is widely distributed. *L. macrolepis* is a native of China; it was first discovered in the province of Yunnan, and afterwards in Formosa, where it furnishes valuable timber. It has been introduced into cultivation by Messrs. J. Veitch & Sons, but it is uncertain whether it will prove hardy in this country. A description of the plant is given.—*G. S. S.*

Lilium speciosum. By Arthur R. Goodwin (*Gard.* p. 313; 9/11/1901).—A successful grower of this plant and its many varieties gives his experience of how it may best be treated. An illustration of a bed of *L. speciosum* accompanies the notes.—*E. T. C.*

Lime: Effect on Different Crops on Acid Soils (*U.S.A. Dep. Agr. Bull.* 133, *Exp. Stn. Work,* xviii. 1901).—An acid condition of the soil being found to be more prevalent than is usually supposed, experiments were made with lime at the Rhode Island Station. The principal result was an indication of the plants benefited by liming (amongst others, Rhubarb, Asparagus, Red Raspberry, Red and White Currants, Barley, Oats, Spring Wheat, Mangel-Wurzels, Onions, English Turnips, Sweet Peas, Balsams, Poppies, &c.), plants not benefited by liming, and plants giving inconclusive results with liming.—*C. H. C.*

Lime-washing Trees. By E. Ouvray (*Bull. Soc. Hort. Loiret,* tome vi. No. 13, p. 577; 1901).—Points out error made in mixing washes by using acids and alkalis that neutralise each other.—*E. A. B.*

Liverworts. ("Ueber die im Jahre 1900 in Baden gesammelten Lebermoose.") By Karl Müller, Freiburg i. Brg. (*Beih. Bot. Cent.* bd. x. ht. 4, 5, pp. 213–223).—A list of sixty-seven *Hepaticæ* collected in Baden by the author, with full details of habitat and locality.

G. F. S.-E.

Lonicera Hildebrandiana. By E. Jenkins (*Gard.Chron.* No.771, p. 254; October 8, 1901).—This handsome plant, which was flowered this summer by the late Mr. Ewbank at Ryde, is commented on, and the best position for its growth discussed.—*G. S. S.*

Loquat. Anon. (*Jour. Hort.* p. 428; November 1).—This fruit (*Eriobotrya japonica*) is figured, and its cultivation in Staffordshire described.—*C. W. D.*

Lycaste Micheliana, Cogn. (Cogniaux in *Dict. Icon. Orch.*, *Lycaste*, pl. 8; 11/1901).—Introduced by M. Marc Micheli, of Geneva, in 1900, from Mexico. Sepals greenish-yellow; petals and lip orange, the latter spotted with red; flowers fragrant. This species much resembles *L. aromatica*, Lindl.—*C. C. H.*

Maize Hybrids. By H. J. Webber (*U.S.A. Dep. Agr.*, *Div. Veg. Physiology, Bull.* 22; 6/1900).—This bulletin is a contribution to the literature on "Xenia," or the immediate effect of pollen upon the character of the seed or fruit. Experimental evidence is adduced in support of the theory that "xenia" is the result of the double fertilisation of the ovule by the two nuclei of the pollen grain, and that grains showing "xenia" are always hybrid. "Xenia" is almost always (perhaps invariably) confined to the embryo and endosperm, while it seldom (or never) extends to the pericarp. Gaertner (in 1848) and Berkeley (see *Gard. Chron.* 1854, p. 404) both distinctly assert that "xenia" influences the seed-coats of Peas. The paper is illustrated with four plates, showing the changes in form and colour produced by "xenia" in Maize grains, and the differences between the hybrid plants and their parents.—*F. J. C.*

Manures, Effect of (*Woburn 2nd Rep.* 1900, p. 98).—Amongst many varieties of Gooseberries, Black Currants, and Raspberries, the bushes being young and soil good, little benefit to crop was found either with 12 or 30 tons of dung per acre, or their equivalent in artificials. The only evidence of effect of manure was in increased luxuriance of foliage and size of berries in Gooseberries when dunged.

Apple and Pear trees, when young, show little benefit from various kinds of manuring, the conclusion arrived at being that as long as a tree is growing well, and making sufficient amount of firm new wood every season, it requires no additional manure.

Growing grass over the roots of young fruit trees is found most injurious, even more so than weeds (due probably to increased evaporation and diminished access of air to the roots).—*C. H. H.*

Masdevallia erythrochæte, Rchb. f. (Cogniaux in *Dict. Icon. Orch.*, *Masdev.*, pl. 15; 8/1901).—Introduced by Messrs. Sander, of St. Albans, either from Central America or Colombia, in 1882.—*C. C. H.*

Masdevallia Schröderiana (Cogniaux in *Dict. Icon. Orch.*, *Masdev.*, pl. 16; 9/1901).—Introduced by Baron Schröder in 1890. Flowers small, crimson and white, with yellow tails.—*C. C. H.*

Matricaria sabulosa. By A. H. Wolley Dod (*Journ. Bot.* 468, pp. 399–400; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Melittis Melissophyllum. Anon. (*Gard. Mag.* 2,509, p. 778; 30/11/1901).—A descriptive and cultural note of this beautiful and uncommon hardy herbaceous plant, which is the only species of the genus in cultivation. A good illustration is given of the plant as it grows in the Rock Garden at Kew.—*W. G.*

Melon Louse. By E. M. Willcox (*U.S.A. Exp. Stn. Oklahoma,* 1900; with figs.).—The Melon louse (*Aphis cucumeris*) did much damage to the Melons in the previous year. But little information is given, save to recommend spraying with the usual kerosene emulsion.

M. C. C.

Mirabelle 'Gloire de Louveciennes.' By H. Dauthenay (*Rev. Hort.* p. 476; October 1901).—Coloured plate. New variety raised by M. Lecointe, resembles in form and colour the double Mirabelle or 'M. de Nancy,' but is much larger and very sweet; flavour of Mirabelle with a touch of Apricot. Highly commended.—*C. T. D.*

Moth, the Brown-tail (*Euproctis chrysorrhœa*). By F. L. Harvey (*U.S.A. St. Bd. Maine, Ann Rep.* 1900. *In the Report of Experiment Station,* p. 36).—A short but interesting paper on this pest is given. Described as a native of Europe, Northern Africa, &c., and imported to Maine about 1894. A dangerous enemy of the Pear and many other trees, shrubs, &c. The description of its eggs and the habits of the caterpillars are given, also the best known precautions.—*V. J. M.*

Moth, The Codlin. By Walter W. Froggatt (*Agr. Gaz. N.S.W.* p. 1,354–65; November 1901).—An illustrated article dealing with this pest under the following headings:—"Life-History," "Method of Dealing with the Pests on the Trees, in the Fruit or Packing Houses, and with Windfalls and Picking off Damaged Apples," "How the Moth is Spread," and "The Law in Tasmania, South Australia, Victoria, Queensland, and West Australia with regard to the Codlin Moth." A report follows on the experiments which have been carried out to check the moth.

A. W. S.

Movement of Water in Living Plant Tissues. By Karl Fuchs (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 305–308).—The author sums up his conclusions as follows:—"A cell containing an osmotically active substance works as a pump if this substance is a non-homogeneous solution."—*G. F. S.-E.*

Mulgedium? (Blue-flowered Lettuce). By H. Correvon (*Rev. Hort.* p. 405; September 1901).—A possible new species, if not *M. Bourgæi,* which it much resembles. Described as a superb plant, highly decorative, and with gigantic panicles of blue flowers, attracting great attention in the Alpine Garden at Geneva; 2½ to 3 metres high. Flowers from June

until autumn. Flowers stand well after cutting. Introduced from the Caucasus by MM. Levier and Sommier (Florence) as *M. albanum*.
C. T. D.

Muraltia brachypetala, demissa and recurva. By A. H. Wolley Dod (*Journ. Bot.* 468, pp. 397-8; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Musa Arnoldiana (*Jour. Soc. Nat. Hort. Fr.*, p. 995).—A new variety of *Musa*, of value for outside summer decoration, from the Congo State. It stands the sun well, has fine foliage with reddish centre stems, and leaves of great substance, which resist the wind, not tearing into ribands as the leaves of *Musa Ensete* do. First-class certificate of the Society awarded.—*G. P.*

Musas, New. By Em. Rodigas (*Bull. Soc. Hort. Loiret*, tome vi. No. 15, p. 695; 1901).—Notice of ten species, calling attention to the advantages of *M. religiosa* for sub-tropical gardening, owing to its leaves resisting wind, and more especially its habit of forming a resting bulb at the base, from which it can easily be preserved for another season.
E. A. B.

Narcissus Parasite. M. Boudier has described (in *Bulletin de la Soc. Bot. de France*, xlviii. 1901, with plate) a new disease on the leaves of *Narcissus poeticus*, after flowering. This parasite is a mould, *Cercosporella Narcissi*, with short hyphæ (20 μ) and conidia, of the usual form ($50-130 \times 4-5$ μ), produced upon discoloured spots.
M. C. C.

Native Plants of South Dakota. By D. A. Saunders (*U.S.A. Exp. Stn., S. Dakota, Bull.* 64).—This bulletin of 180 pages gives a list of the native plants of South Dakota, with the scientific and common names, the locality, and a few synonyms.—*F. J. C.*

Native Trees of Rhode Island. By Levi W. Russell (*U.S.A. Stn. Bd., Rhode Is.*, 1900; 19 plates).—This pamphlet gives an annotated list of the trees of Rhode Island, with illustrations of the chief. The form of the tree and the characteristics of the wood of those useful as timber are noted.—*F. J. C.*

Naturalisation of Plants in France. By Ch. Flahault (*Bull. Soc. Bot. France*, xlvi., 1899; Sess. Extraord. à Hyères, Mai 1899 (published November 1901), pp. xci-cviii).—An account is given of the various modes in which foreign plants have been accidentally introduced into France, and of those which have been naturalised by cultivation. Only twenty-five of these, the names of which are given, are regarded by M. Flahault as being definitely acclimatised; and of these only one, *Nicotiana glauca*, is a woody plant. All other foreign trees and shrubs are dependent on the care of man for their maintenance.—*A. W. B.*

Neonicholsonia. By U. Dammer (*Gard. Chron.* No. 787, p. 178; September 7, 1901).—A new genus of Palms from Central America. The species are stemless, with pinnated fronds of from 4 to 6 feet in length, and said to be worthy of cultivation.—*G. S. S.*

New Arrivals in the Plant-world of Middle Europe during the last Fifty Years. By Dr. F. Höck (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 284–300).—The paper contains a great many new records for such plants as *Claytonia perfoliata*, *Œnothera* spp., &c., and also records as a new species *Geranium Endressi*, from the Pyrenees, which is beginning to establish itself at Bonneville. It is chiefly interesting as showing how plants from almost every part of the world can establish themselves in Europe (*e.g.*, Patagonia, Japan, Alaska, and the Caucasus).
G. F. S.-E.

New European Plants (*Beih. Bot. Cent.* bd. xi. ht. 4, pp. 261–281).—Dr. Höck continues his list of new localities of European weeds and introductions. Two new species, *Papaver commutatum* and *Sophora japonica*, are recorded. The new localities form a long list, which shows that many American plants are well able to establish themselves in Central Europe.
G. F. S.-E.

New Introduction, Plants of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* 9, 10, 11, pp. 260, 307, 326; 1901).—Description of *Angelonia integrifolia* Spreng. (Scrophulariaceæ), from Brazil and Paraguay; *Salvia sicheana* (Labiatæ), from Asia Minor; *Richardia macrocarpa*, Engl., from South Africa; and *Asparagus virgatus*, Baker, from South Africa. An interesting account of *Cordyline cannæfolia*, R. Brown, *Crinum* × *Alexandræ*, *Crinum* × *Victoriæ*, *Gerbera Jamesoni*, *Crinum* × *Belladonna*, *Crinum* × *Fortunæ*, *Vernonia arkansana*, DC., *Acanthus latifolius tricolor*, *Iris dichotoma*, Pall., *I. tectorum*, Maxim., *Acrospira asphodeloides*, Welw., *Veronica fasciculata*, Michx., *Iris talischi*, Forster, *Acanthus arboreus*, Forsk., *Aloe Cooperi*, Bak., *Asparagus suaveolens*, Burch., *Salvia verbascifolia*, Bieb., *Asparagus racemosus*, Willd.—*W. C. W.*

Nicotiana, Hybrids of. By J. Daveau (*Rev. Hort.* pp. 545–8; December 1901).—With two illustrations showing hybrids between *N. sylvestris* and *N. Tabacum*, both bold and extremely floriferous plants. The hybrids are sterile, but appear to be easily re-obtained on same lines by fresh crosses.—*C. T. D.*

Night Moths, Destruction of, by Acetylene. By H. Dauthenay (*Rev. Hort.* pp. 544–5; December 1901).—Description of a trap consisting of a barrel with one side removed, or a lidless box, the inside of which is covered with molasses. A lamp with reflector being placed therein, the moths are attracted and trapped. Immense numbers have thus been destroyed. Another trap is described in which the lamp is placed over a tub containing an inch or two of water covered with petroleum or schist oil.—*C. T. D.*

Nycterinia selaginoides. By Ed. Michel (*Rev. Hort.* pp. 402–3; September 1901).—One woodcut. A dwarf, compact annual, bearing innumerable white or pale lilac flowers for more than two months, from end of April onwards. Highly commended for carpet bedding or pots. Culture easy. Full directions given for raising. To sow in September,

and protect from frost and damp during winter, appear to be all that is needed.—*C. T. D.*

Nymphæa × Pennsylvania (H. S. Couard, University of Pennsylvania, in *Amer. Gard.* xxii. p. 745, fig. 155; 2/11/1901).—A new and interesting hybrid between *N. cærulea*, Sav. ♀, and *N. zanzibariensis*, Casp. ♂, raised in the Botanic Gardens of the University by Mr. Couard. Sepals and outer petals dark green, spotted black, without; dull white above, greenish below, within; inner petals soft light blue; growth extremely vigorous, but apparently almost sterile. In the number of segments, sepals, petals, stamens, and carpels the hybrid is almost an exact mean between its parents.—*C. C. H.*

Odontoglossum × Adrianæ, L. Lind. (Cogniaux in *Dict. Icon. Orch.*, *Odont.* hyb., pl. 10; 9/1901).—A natural hybrid between *O. crispum* and *O. Hunnewellianum*, with which it grows in Colombia. First flowered by Messrs. Linden, of Brussels, in 1897. Flowers yellow, blotched with chocolate; lip white, dotted red.

Var. 'André' (*Id.* pl. 10A).—Appeared with M. Graire, of Amiens, in 1901. Flowers broad, cream colour with many purple-brown blotches; lip pale yellow, with spots of same colour.

Var. 'Queen Alexandra' (*Id.* pl. 10B).—Appeared with Mrs. Briggs-Bury, of Accrington, in 1901. Flowers very large and broad, whitish yellow, covered with large masses of a rich chocolate colour. *C. C. H.*

Odontoglossum × Braeckmani (L. Linden in *Lind.* xvi. pl. 744; 1/7/1901).—A hybrid raised by M. Metdepenningen, of Ghent, and supposed to be between *O. Halli* and *O. Harryanum*. Flowers greenish yellow, shaded with white at the base of petals and irregularly spotted, dotted, and lined with chocolate brown.—*C. C. H.*

Odontoglossum × crispo-Harryanum amœnum, Cogn. (Cogniaux in *Dict. Icon. Orch.*, *Odont.* hyb. pl. 8; 5/1901).—A remarkable hybrid from *O. crispum* ♀ × *O. Harryanum* ♂, raised by M. Vuylsteke, of Ghent, in 1898. Intermediate in form and colour.—*C. C. H.*

Odontoglossum × crispo-Harryanum spectabile, Cogn. (Cogniaux in *Dict. Icon. Orch.*, *Odont.* hyb., pl. 8A; 5/1901).—A hybrid from *O. Harryanum* ♀ × *O. crispum* ♂, raised by M. Vuylsteke in 1899. Flowers large, approaching *O. Harryanum* in form and colour.—*C. C. H.*

Odontoglossum crispum auriferum, L. Lind. (L. Linden in *Lind.* xvi. pl. 722; 1/1/1901).—A variety which appeared with Messrs. Linden in 1900. Flowers medium, broad, pure white with golden-yellow spots, except the petals, which are immaculate.—*C. C. H.*

Odontoglossum crispum 'Quo Vadis,' L. Lind. (L. Linden in *Lind.* xvi. pl. 781; 1/8/1901).—A remarkable form of this popular species. Flowers broad and crisped, white, the sepals and lip almost

covered with an irregular blotch of chocolate-brown, while the petals have a similar blotch of a rich purple red. Introduced in 1900 by Messrs. Linden, of Brussels.—*C. C. H.*

Odontoglossum × tentaculatum, Rchb. f. (Cogniaux in *Dict. Icon. Orch., Odont.* × pl. 9; 5/1901).—A natural hybrid, probably between *O. luteo-purpureum* and *O. gloriosum*, and thus a form of *O.* × *Mulus*. Introduced from Colombia by Messrs. Sander, of St. Albans, and first flowered in 1883 with Baron Schröder.—*C. C. H.*

Odontoglossum triumphans rubrum (Cogniaux in *Chron. Orch.* p. 322; 5/1901).—Flowers with broad segments; sepals and petals deep red, tipped with orange and veined with greenish yellow; lip white below with orange crest, deep red above. This form appeared with M. de Lairesse, of Liége, in an importation of *O. crispum*.—*C. C. H.*

Odontoglossum Wilckeanum, Rchb. f. By F. Kränzlin (*Gartenflora*, p. 617, pl. 1,493; 1/12/1901).—A coloured plate and description of the plant.—*J. P.*

Omphalea megacarpa (*Bull. Bot. Dep. Trinidad* 31, p. 385; October 1901).—A note confirming, after due trial, the properties of its seeds as a safe and efficient purgative.—*E. A. B.*

Oncidium Marshallianum aurantiacum (Cogniaux in *Chron. Orch.* p. 322; 5/1901).—Flowers sulphur-yellow with pale brown bands on sepals, and spots on petals, lower half of petals and lip orange-yellow. From M. de Lairesse, of Liége.—*C. C. H.*

Oncidium stelligerum Ernesti, Williams (L. Linden in *Lind.* xvi. pl. 743; 1/7/1901).—Introduced from Mexico in 1873; near to, if not syn. with, *O. hastatum*. It is interesting as a sort of link between *Miltonia*, *Oncidium*, and *Odontoglossum*. This variety appeared with Mr. Measures, of Camberwell, in 1886. Flowers yellow, with large brown spots; lip with apical lobe deep rosy purple.—*C. C. H.*

Oncidium tigrinum Monteflorae, Cogn. (Cogniaux in *Dict. Icon. Orch., Oncid.*, pl. 4B; 3/1901).—From M. de Lairesse, of Liége. A pale form of the type.—*C. C. H.*

Oncidium tigrinum splendidum, Hook. f. (L. Linden in *Lind.* xvi. pl. 747; 15/9/1901).—This variety was introduced into France about 1850. Pseudo-bulbs smaller, bearing a single leaf; flowers less numerous, brilliantly coloured yellow and chocolate.—*C. C. H.*

Oncidium varicosum Lindeni (L. Linden in *Lind.* xvi. pl. 752; 5/9/1901).—This lovely variety appeared with Messrs. Linden in 1899. Lip rich yellow with a large maroon-brown area round the crest.
C. C. H.

Onion. By R. (*Bull. Soc. Hort. Loiret*, tome vi. No. 15, p. 695; 1901).—Fungoid disease of Onions traced to watering with manure water.—*E. A. B.*

Onion Growing (*U.S.A. Exp. Stn. Texas, Bull.* 60; 6/1901; 6 figs., 5 plates).—Gives an account of horse *versus* hand culture in growing Onions for market, and reports in favour of the latter.—*F. J. C.*

Onion Smut. By Sirrine and Stewart (*U.S.A. Exp. Stn., New York, Bull.* 182; 12/1900).—Gives an account of the result of treating the soil in which Onions are sown with sulphur-lime, as a preventive of the attacks of the fungus *Urocystis cepulæ*, and recommends the same for bad attacks. The best remedial measure is, however, transplanting. *F. J. C.*

Onion Thrip. By Prof. Webster, Ohio (*Amer. Gard.* xxii. pp. 776, 777, fig. 162; 16/11/1901).—A troublesome pest in America, which attacks a large number of distinct plants, including the Onion, Leek, Tobacco, Tomato, Wheat, Cabbage, Turnip, Cucumber, and many grasses. It is commonly known as the "White Blast," and is difficult to control on account of its prevalence among a variety of weeds. Of the many remedies tried, a spray mixture of 1 lb. of "Standard" soap dissolved in 8 gallons of water gave the best result.—*C. C. H.*

Onions and Leeks.—By H. Roberts (*Gard. Mag.* 2,518, p. 861; 28/12/1901).—The writer gives some interesting historical notes on the Onion and Leek, together with poetical allusions to these common vegetables. Some sensible remarks on the cookery of both Onions and Leeks may be useful to many.—*W. G.*

Opuntias, Out-door. By R. I. Lynch (*Gard. Chron.* No. 780, p. 408, figs. 122 and 123, December 7, 1901).—Descriptions and figures are given of three species that are grown out of doors at Cambridge, with only very slight protection in the coldest weather.—*G. S. S.*

Orchard Notes. By W. J. Allen (*Agr. Gaz. N.S.W.* p. 1,172, September 1901; p. 1,278, October 1901; p. 1,441, November 1901).—Valuable information regarding the treatment of orchard trees, together with coloured plates of Fox's Seedling and Globe Peaches, La Comte and Beurré Clairgeau Pears, and Lamb Abbey Pearmain and Jonathan Apples.—*A. W. S.*

Orchid, A new Parasitic Fungus on an (*Gartenflora*, p. 582; 1/10/1901).—A new species of *Nectria* (*Nectria bulbicola*, P. Henn.) was discovered to be the cause of damage to the tubers of *Maxillaria rufescens*, Lindl. The leaves of the affected plants fall off, and brown spots appear on the tubers; the diseased spots soon extend, and the tubers finally decay.

Three or four species of *Nectria* are already known upon Orchids, but their conidia and ascospores differ from those of the species now described.

The perithecia of the fungus appear to be formed chiefly during the dull weather of winter. Bright sunlight checks the disease somewhat, but all diseased tubers and associated roots should be carefully removed as soon as the complaint is observed.—*J. P.*

Orchids from Seed, Raising. By F. W. Thurgood (*Garden*, No. 1,577, p. 96; 8/2/1902).—So many cultivators of Orchids are now endeavouring to raise seedlings that these notes will be opportune. The subject of hybridising is considered, and much useful information given about the seeding of the various genera, preparing the compost and the receptacle, sowing the seed, and the treatment of the seedlings.—*E. T. C.*

Orchids, Hybridisation and Raising of. By J. D. B. (*Gard. Chron.* No. 775, p. 317; November 2, 1901).—The various methods of carrying out these objects are thoroughly discussed in a long paper. The difficulty of obtaining seed is said be often the result of fertilising immature flowers, and, given good seeds, it seems to be a very simple matter to raise them provided suitable quarters can be found.—*G. S. S.*

Pæonia arborea. By A. Unger (*Gard. Chron.* No. 772, p. 270; October 12, 1901).—An interesting account is given of a journey undertaken to visit the Japanese Pæony Gardens, or rather fields, where these plants are grown in enormous numbers and the blossoms sent in large bunches to Osaka and other towns.—*G. S. S.*

Pæonies, Herbaceous. By E. H. Jenkins (*Gard. Chron.* No. 772, p. 274; October 12, 1901).—The cultivation of these plants is fully described, the time to plant, the best soils and manures, and other details are given.—*G. S. S.*

Palm, a Coloured Cyrtostachys, Renda Duvivieriana (*Rev Hort.* p. 490; November 1901).—Dwarf with Areca-like foliage, with carmine-coloured petioles of deeper tint than the type. Various other tinted Palms are cited, but this ranks with the best.—*C. T. D.*

Palms of Uruguay. By Ed. André (*Rev. Hort.* pp. 468–9; October 1901).—An interesting list, published by Señor Barbora-Rodriguez, Director of the Botanical Garden, Rio de Janeiro. Extract given relating to the genus Cocos, defining its sections as regards S. American species.
C. T. D.

Palms, Collection of, at Ospedaletti. By Y. (*Bull. R. Soc. Tosc. Ort.* 9, p. 281; Sept. 1901). List of Palms grown by Comm. Jonquière, Director of the "Foncière Lyonnaise" Society, at Ospedaletti, near San Remo, with some remarks on the comparative values of various Palms for decorative usage.—*W. C. W.*

Palms, Root Tubercles on (*Amer. Gard.* xxii. p. 857; 21/12/1901).—Mr. F. O. Cook, in the Bulletin of the Torrey Botanical Club, records the discovery of root tubercles on the Royal Palm of Florida; so that it appears we must add Palms to the *Leguminosæ*, *Podocarpus*, *Alnus*, and *Cycas*, as plants which possess nitrogen-collecting soil organisms. It may be interesting to note that this particular species of Palm is commonly referred to *Oreodoxa regia*, though with doubtful propriety. And after careful comparison with other allied species, Mr. Cook decides to treat the Royal Palm of Florida as a distinct species under the name of *Roystonea floridana*.—*C. C. H.*

Palms, Garden. By Udo Dammer (*Gard. Chron.* No. 778, p. 370, figs. 112 and 113, November 23, 1901).—Showing the differences between various species suitable for cultivation in gardens.—*G. S. S.*

Parasites, Epiphytes, and Saprophytes (*Bull. Bot. Dep. Trinidad* 31, p. 398; October 1901).—A local study of, defining their different effects, and acquitting the latter two classes of plants of causing harm in general cases.—*E. A. B.*

Pathology, Vegetable, and Manures. By Ch. Baltet (*Rev. Hort.* pp. 473–4).—Abstracts of papers read at the Arboricultural Congress in 1901 by M. Pierre Lesne, M. Passy, and M. Georges Truffaut relating to insect and other attacks, and their prevention and cure, composition of soils, &c.—*C. T. D.*

Peach-leaf Curl. By W. A. Murrill (*U.S.A. Exp. Stn. Cornell Univ. Bull.* 180; 3/1900).—Details results of spraying Peach-trees against leaf-curl with Bordeaux mixture, potassium sulphide, and ammoniacal copper carbonate, and recommends spraying with Bordeaux mixture (6 lb. copper sulphate, 4 lb. good quicklime, and 50 galls. water) when buds begin to swell and again after petals have fallen; if weather has been damp and cold, with a mixture made of 2 lb. copper sulphate, 2 lb. quicklime, and 50 galls. water.—*F. J. C.*

Peach Orchards, Pruning and Training. By R. H. Price (*U.S.A. Exp. Stn. Texas, Bull.* 58; 12/1900; 15 figs.).—Contains some good remarks on the subject indicated, especially in regard to the method of pruning which answers best in Texas.—*F. J. C.*

Peach-planting in Maryland. By T. J. Shallcross (*U.S.A. Hort. Soc. Maryland*, 1898).—First culture outside N. Jersey in 1825. Greatest impetus to Peach culture in Maryland from 1856 to 1865. Enumeration of varieties planted. While Peach-growing has been very profitable, and some persons have laid up considerable money, yet three-fourths of the Peach-growers are not much better off than if they had raised grain crops.—*M. C. C.*

Peach 'Wellington,' Stone and Wellington (in *Amer. Gard.* xxii. p. 699; 12/10/1901).—A new seedling, *hardy in Toronto City*; medium size, good appearance, and rich flavour.—*C. C. H.*

Peach Yellows, Suggestions in regard to. By Prof. C. O. Townsend (*U.S.A. Hort. Soc. Maryland*, 1899, with figs.).—Acknowledged to be incurable and infectious. The only remedy is the eradication of all infected trees. It should be remembered that an orchard is not safe so long as it contains a single yellow tree. All such trees should be marked, so that they can be destroyed at an early date. No pains should be spared to remove every affected tree as soon as the "yellows" appears.—*M. C. C.*

Pear 'Mathilde Recy.' By Em. Rodigas (*Bull. Soc. Hort. Loiret*, tome vi. No. 13, p. 540; 1901).—Origin and description of, ripening November and December.—*E. A. B.*

Pear 'Munz's Apothecary.' By C. Mathieu (*Gartenflora*, p. 505, pl. 1,491 ; 1/10/1901).—Coloured plate and description of an early Pear, ripening about the beginning of August.—*J. P.*

Pears for Cold, Wet Soils. By Alger Petts (*Gard.* p. 429 ; 28/12/1901).—An article giving much useful information on the best varieties for the purpose.—*E. T. C.*

Pelargoniums, Scented-leaved, and their Culture. By John Denman (*Garden*, No. 1,576, p. 76 ; 1/2/1902).—The writer says these plants are second, if not equal, to the Zonal Pelargoniums in usefulness, and after a period of neglect have again come into favour. Their propagation is described and full cultural directions given, from the earliest stages to the flowering. The most useful varieties are also noted.—*E. T. C.*

Pelargonium Zonal, New Race of. By H. Dauthenay (*Rev. Hort.* pp. 424–5 ; September 1901).—Descriptions of ten fine varieties, highly recommended : 'Edouard André,' 'Henry Barnsby,' 'Eugénie Buret,' 'François Bernier,' 'Henri Dauthenay,' 'Mme. Ed. André,' 'Mme. Hy. Barnsby,' 'M. Buret,' 'William Barnsby,' 'Mme. Reverdy.' All, with as many more, obtained by M. Buret-Reverdy, Tours.—*C. T. D.*

Pergolas for Roses and other Plants (*Gard.* p. 301 ; 2/11/1901).—A beautifully illustrated article on pergolas covered with Clematis, Roses, Wistaria, &c., and explaining the formation of pergolas and the best plants for covering them.—*E. T. C.*

Phalænopsis amabilis Rimestadiana, L. Lind. (L. Linden in *Lind.* xvi. pls. 786-787 ; 1/5/1901).—Introduced in 1847 from the East, where it spreads over a wide area, Borneo, New Guinea, Java, &c. A beautiful variety of the species. Flowers pure white ; lip margined with yellow and dotted crimson at the base.—*C. C. H.*

Phillyrea. "Remarques sur le *Zaghouania Phillyreæ.*" Par P. Dumée et R. Maire (*Bull. Soc. Myc. de Fr.* xviii. 1902, with fig.).—Description of a new form of parasite on *Phillyrea media* belonging to the Uredines. The first stage represented by *Æcidium Phillyreæ*, DC. The second, or *Uredo* stage, by *Uredo Phillyreæ*, Cooke, found in Britain. The third stage, or teleutospores, discovered in Corsica and Tunis, and now denominated *Zaghouania Phillyreæ*, in which the preceding form species are to be merged. This is a true parasite on adult living leaves of *Phillyrea media* and other species.—*M. C. C.*

Phlox, variegated, 'Ferdinand Lahaye' (*Rev. Hort.* p. 515 ; 11/1901).—Raised accidentally by M. Gerbeaux, Nancy. Bold foliage, strongly marked with golden-yellow at the margin and in stripes at various angles.—*C. T. D.*

Phœnix Roebelenii O'Brien. By O. K. (*Bull. R. Soc. Tosc. Ort.* 9, p. 288 ; Sept. 1901).—Sent by M. Roebeleni, in 1889, from Singapore to Mr. Protheroe in London. Mr. James O'Brien gave it the above name. No one knows precisely the native country of the plant ; its most

successful cultivators are inclined to regard Southern India or Southern China as its home. On account of its dwarfed size, its gracefulness, and resistance to cold, it is one of the best species for room and table decoration. According to one successful grower of the plant, it is easy of cultivation when not kept in the suffocating atmosphere of a warm stove. Palms from warm or temperate regions demand air and light rather than heat. Like *Kentia*, this Palm must be grown in a temperate house.

W. C. W.

Phosphatic and Potash Fertilisers. By J. J. Willis (*Gard. Chron.* No. 780, p. 411, December 7, 1901).—This paper, which is not concluded, deals with certain manures, giving their composition and the conditions in which they are most useful.—*G. S. S.*

Phragmipedilum (Selenipedium) × macrochilum. J. E. Rothwell (in *Amer. Gard.* xxii. p. 763, fig. 160; 9/11/1901).—A hybrid from *P. Roezlii* and *P. caudatum Lindeni*, with a graceful habit, bearing 3–4 flowers of a yellow shade. As *P. Roezlii* is now considered to be a form of *P. longifolium*, the correct name of this hybrid is *P.* ×*grande macrochilum*. It is interesting to note that the lip of this hybrid is quite normal, while that of one of its parents is petaloid.—*C. C. H.*

Phylica Dodii. By N. E. Brown (*Journ. Bot.* 468, p. 399; 12/1901).—Description of new species from Paulsberg, Cape Colony.—*G. S. B.*

Pineapple Growing. By Peter H. Rolfs (*U.S.A. Dept. Agr. Bull.* 140; 1901; figs. and tabs.).—This pamphlet of forty-seven pages gives a short and concise history of the gradual adoption and cultivation of the Pineapple in the open in the U.S.A., derived from experimental research and from the limited amount of literature at present available on the subject.

It touches on all the principal points connected with the cultivation gathering, shipping, storing, and canning, and the diseases of this important crop, and, besides being illustrated with several figures, contains tables of soil analysis in Florida and elsewhere.

The mechanical fertility of the soil appears to be, where the Pine is concerned, of far more importance than the presence of chemical and organic elements of plant food, notwithstanding these have to be applied in the form of fertilisers as required. The epiphytic nature of the Pine family to some extent explains this trait.

A mean temperature of from 75° to 80° suits the Pine best. Amongst eighteen varieties named, the "Red Spanish" is that most universally grown.

Florida, the Keys, Hawaii, Porto Rico, the Philippines, &c., all possess good Pine-growing lands.

Proper handling at the time of gathering is most important, also that the fruit should be *dry* when gathered.

In Florida it is packed, after grading, in barrel and half-barrel crates.

In the Bahama Islands and West Indies it is still shipped in bulk.

Cold storage for Pines has not yet been developed in the States.

The European markets are supplied from Madeira, the Canaries, the Azores, &c.

Amongst fertilisers, blood and bone or cotton-seed meal are a valuable medium for the application of ammonia, conveying at the same time the necessary amount of phosphoric acid.

Potash should be added when required, preferably in the form of carbonate. Kainit should be avoided. The following formula is given as being useful on poor and deficient soils :—

Ammonia	4 per cent.
Potash	6 „ „
Phosphoric acid . . .	1 „ „

1,000 lb. to the acre for the first application ; 1,500 for the second ; but the figures and formulæ are only approximate.

Suckers are the chief form of propagation for the common varieties.

Slips are only used for the higher-priced varieties, or when plants are scarce.

The best season for setting out the suckers is from July to November.

After-cultivation consists chiefly in stirring the soil and keeping free from weeds.

It is especially necessary to avoid breaking the leaves, as once the epidermis is broken the plant loses moisture rapidly and much damage results.

Pineapples do not suffer from many diseases. Besides mealy bug, red spider, &c., and the Pineapple scale (*Diaspis Bromeliæ*), for which the usual remedies are in vogue, this plant is attacked by a special kind of blight, due to a fungus in the soil, by fruit mould, from bruising, by tangle root, spike, black-heart, and a natural process called "sanding," which smothers the bud.

It has been found beneficial to grow Pines under sheds, as partially shaded plants result in more tender and juicy fruit than when grown in the open, besides the protection afforded in the case of frost.

The use of trees for shade as an alternative to sheds has not received sufficient attention, but the author speaks of the advantage derived by a crop of Pines from the shade and protection afforded by such trees as the Cabbage Palmettos.

It is thought probable that the use of leguminous trees, such as the "Royal Ponciana," the "Rain Tree," &c., besides giving shade and protection, might sensibly increase the amount of nitrogen in the soil, as has been found to be the case in Coffee plantations, and thus greatly reduce the cost of producing the finer varieties of Pineapples. As a by-product, Pineapple fibre is thought worthy of increased attention, with a view to its use in the textile industry.—*C. H. C.*

Pinks, 'Marguerite,' Dwarf. By Jules Rudolph (*Rev. Hort.* pp. 409, 410; 9/1901).—Three woodcuts. Description of varieties, and instructions for treatment as annuals by autumn sowings for flowering the following May.—*C. T. D.*

Piptanthus nepalensis. Anon. (*Jour. Hort.* p. 250; September 12).—Figured and described as a moderately hardy shrub, bearing papilionaceous flowers in bunches.—*C. W. D.*

Pitcairnia Micheliana. By Ed. André (*Rev. Hort.* pp. 576, 577; 12/1901).—Coloured plate. A pretty scarlet-flowered Bromeliad with pendulous linear foliage, suited for temperate house. Native of Mexico. *C. T. D.*

Pithecolobium Saman. Anon. (*Bull. Bot. Dep. Trinidad*, No. 29, p. 347; July 1901).—This tree is recommended as a shade for Cacao, and the question of the manurial value of its shed leaves and blossoms discussed, but left undecided.—*E. A. B.*

Pithecolobium Saman, Nitrogen Accumulated by Roots of (*Bull. Bot. Dep. Trinidad*, No. 31, p. 396; October 1901).—Describes the advantages derived by a crop of *Cedrela odorata* planted within the root area of the Saman.—*E. A. B.*

Pittosporum crassifolium. Anon. (*Gard. Chron.* No. 781, p. 431, fig. 130, December 14, 1901).—The "Karo" of New Zealand is said to be of great value for shelter, especially in positions near the sea, as it resists the fiercest gales, and may be found growing in places where it is exposed to the influence of the spray. It should be tried on the southern and south-western coasts, and in other suitable localities.—*G. S. S.*

Pittosporum undulatum. By Georges Daurel (*Rev. Hort.* p. 401; 9/1901).—One woodcut, representing handsome shrub in the open at Bordeaux. Native of New South Wales, and rather tender.—*C. T. D.*

Plant Collectors. By F. W. Burbidge (*Gard. Mag.* 2,510, p. 795; 7/12/1901).—An interesting account of the various men who have distinguished themselves in the arduous work of plant collecting in foreign countries during the past century. The list is a long one of those who have become famous in this direction, and they include men of various nationalities who have been employed chiefly by the English in the work of enriching our gardens with exotic vegetation. A list is given of the more conspicuous introductions of the several collectors. The writer, himself a plant collector, has evidently endeavoured to make the account as comprehensive as possible.—*W. G.*

Planting (*Woburn, 2nd Rep.* 1900, p. 177).—Experiments of cultural nature have been made, such as the effect of depth of cultivation, pruning, at what time planted, cutting back at planting, or leaving till later. In the latter case there seems to be but little choice between cutting back at planting or leaving till one year later; the balance, however, is somewhat in favour of immediate cutting back.

Planting trees in November, January, or March shows nothing on the whole in favour of either of these different times for planting. As to time of pruning, spring appears to be favoured. There are many other experiments in progress, both on bush and standard Apple-trees, including summer pinching, moderate and hard winter pruning, root pruning every one, two, and four years, lifting every second year, mulching with straw. Of manures applied at different seasons, effect of careless planting, relative advantage of holes dug 2 or 3 feet deep (the shallower are preferred). Planting

4 inches too high or 4 inches too low—the latter seems to do but little, if any, injury. Mixing chalk, flint, and gravel in hole when planting proved disadvantageous, whilst peat and good loam prove advantageous. Removal of blossoms has somewhat increased size of leaf and size of tree; if blossoms were removed one year blossoming energy seemed to be increased in the following.

The method used in comparing size and vigour of trees is the weighing of leaves, measurement of girth of stem, and height and spread of tree.—*C. H. H.*

Plant Lice. By J. J. Willis (*Gard. Chron.* No. 768, p. 214; September 14, 1901).—An account is given of the structure, habits, and singular methods of reproduction of these insects, and the best method of destroying them.—*G. S. S.*

Plants, old and rare, Descriptions of (*Die Gart.* p. 103; Nov. 30, 1901).—*Leucojum vernum*, fl. pl.

Galanthus viridescens and *G. flavus.*

Alyssum saxatile, fl. pl., like the common yellow flowering plant, but with double flowers.

Clematis erecta, fl. pl.—A herbaceous non-climbing form with double white flowers.

Adonis vernalis, fl. pl.—A spontaneous German plant with monstrous double yellow flowers.

Hesperis matronalis lilacina, fl. pl., and *purpurea*, fl. pl.—The double lilac and purple Rocket.

Delphinium grandiflorum, fl. pl.—The true old Siberian Larkspur; a perfect perennial, fibrous rooted, with finely cut foliage, ebony black stems, and rose-shaped double dark-blue flowers. The almost as rare single-flowering species differs only in the single flowers. Both are dwarf, growing not over 2 feet in height.

Iris pallida fol. aur. varieg.—A pretty foliage plant.

Scilla bifolia rubra (very rare), with bright rosy flowers.

Primula acaulis rubra, fl. pl., and *rosea*, fl. pl., with crimson and salmon-rose flowers.

Orobus vernus, fl. pl., and *O. versicolor*, fl. pl.—Both rare forms, with double purple and whitish flowers.

Lilium martagon, fl. pl.—Like the double Tiger Lily, this plant has perfect double purple flowers.

Lilium chalcedonicum punctatum, with handsome scarlet-spotted black flowers.

Hepatica triloba atrocærulea, fl. pl. Exceedingly rare. The ordinary double blue Hepatica is not quite as handsome and distinct, which has larger deep blue flowers.

Orchis foliosa alba and *Gentiana acaulis alba.*—The former almost extinct, and the latter at least very rare.

Narcissus triandrus pulchellus, *N. cernuus*, *N. calathinus*, *N. odorus*, fl. pl.—Still known in English gardens, although becoming very rare.

Ourisia coccinea.—Of creeping habit, primula-like leafage and handsome scarlet flowers.

Pæonia albiflora.—The rare, true, large, single white-flowered.

Anemonopsis macrophylla.—Resembling as much a large Anemone as a Clematis; exceedingly rare.—*G. R.*

Polystachya pubescens, Rchb. f. (Cogniaux in *Dict. Icon. Orch., Polyst.*, pl. 1; 11/1901).—A small species from South and S.E. Africa, introduced in 1840. Flowers fragrant, golden-yellow, with crimson-purple lines.—*C. C. H.*

Pomelos. By H. H. Hume (*U.S.A. Exp. Stn. Florida, Bull.* 58 6/1901; 7 plates).—Gives an historical account of the plant (*Citrus decumana*) and of its popular name; a description of the tree and of the chief varieties (the fruits of which are illustrated), and a summary of the composition of the ash of the fruit, with a note as to the best fertilisers to be used in its cultivation.—*F. J. C.*

Potatos (*Woburn, 2nd Rep.* 1900, p. 228).—The trial of planting them at different times—end of March, end of April, and end of May—showed the result that those planted at mid-season did best. Those planted early produced proportionately the most misshapen Potatos. As to size of seed, medium size yielded best. These experiments must year by year be of greater value to fruit farmers and gardeners, and gratitude is due to the Duke of Bedford for carrying out such practical and scientific experiments for the benefit of the country.—*C. H. H.*

Potatos. Spraying Potatos to prevent disease and to increase the yield. By Henry F. Hill (*Qu. Agri. Journ.* ix. p. 3; September 1901). Spraying with strawsonite was not quite so successful as usual in preventing the disease in the tubers, but had a very decided and beneficial effect on their size and the yield of the crop. Spraying has the effect of prolonging the life of the haulms, so that the period of storage for starch and other materials in the tuber is much increased, and the sprayed plots usually yield a larger and more regular sample than the unsprayed. The produce per acre was 7 tons 12 cwt. unsprayed, and 9 tons 14 cwt. sprayed, showing an increased yield of 2 tons per acre.—*M. C. C.*

Potatos, Sweet—Ipomea Batatas (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 4, p. 293).—The Sweet Potato is said to be the most important of all West Indian home-grown food stuffs, and only second to sugar-cane in general importance. They are largely grown by the peasants owing to the ease with which they are propagated, the poor soil in which they will thrive, the small amount of attention they require, and the short time in which they will come to maturity. The crops are represented as enormous, but there is great difficulty in storing the tubers, which keep only a short time. Experiments are now being made with a view to establishing mills for converting the Potatos into flour in order to meet the difficulty of scarcity of food during the dry seasons of the year when the peasants are reduced to the greatest straits. The flour when properly made is said to be quite palatable and satisfactory, but it requires the utmost care in preparation and absolute dryness of storage. Both tubers and foliage are also good for fodder for cattle and for horses. A

spirit is also made from them in St. Michael, which is sent to Portugal to fortify wines for the English market! An attempt has been made to introduce the tubers to the English market, but as yet it has failed to satisfy the English palate.—*W. W.*

Potatos, The Value of Potatos as a Food (*Agr. Gaz. N.S.W.* p. 1,369; November 1901).—A very instructive paper, dealing with the subject in an interesting manner, under the following headings:—"Structure of the Potato," "Composition," "Cooking," "Flavour," "Digestibility and their Place in the Diet."—*A. W. S.*

Primula, Chinese, 'Rêve d'Or.' By Ed. André (*Rev. Hort.* pp. 428, 429; 9/1901).—Coloured plate. Raised by M. B. Chabaud, Toulon. Flowers semi-double, edges somewhat laciniate, centre yellow merging into white at margin. Foliage deeply incised, somewhat fuller and fringed.—*C. T. D.*

Primula sinensis, New Variety of (*Bull. R. Soc. Tosc. Ort.* 11, p. 349; November 1901). Description of the variety *filicifolia gigantea azurea.*—*W. C. W.*

Prunes and Prune Culture in Western Europe. By E. R. Lake (*U.S.A. Dep. Agr. Div. Pom. Bull.* 10).—Deals with the important producing districts, soil, orchard methods, stocks, pruning and training, varieties, packing and packages, marketing, evaporation, chemical composition of Prunes. The bulletin is beautifully illustrated from photographs of orchards and trees of various ages, also several showing the method of drying the Prunes. Among the varieties found suitable for Prunes, Czar and Victoria are the only Plums of English origin included.
C. H. H.

Puccinia pruni. 'Remarques sur les Urédospores de *Puccinia pruni.*' By P. Dumée and R. Maire (*Bull. Soc. Myc. Fr.* xvii. 308, 1901; with cuts).—This communication recognises the presence of two kinds of Uredospores in the pustules of *Puccinia pruni,* the one kind resembling the usual Uredospores of a *Puccinia,* the other not unlike the teleutospores of *Uromyces,* to which genus it has been referred under the name of *Uromyces amygdali.* It is proposed that experiments should be made with both kinds of Uredospore as to their power of germination and infection.—*M. C. C.*

Raspberries.—"Why not grow Raspberries?" By L. C. Corbett (*U.S.A. Exp. Stn. W. Virg. Bull.* 48, 1896, with cuts).—Suggestions for cultivation, harvesting, and curing the fruit, by drying, with forms of evaporators.—*M. C. C.*

Red Spider. By F. H. Chittenden (*Proc. 17th Annual Convention of Soc. Amer. Florists*; Aug. 1901, with fig. 1).—Description and history of this well-known pest, with the usual suggestion of flowers of sulphur mixed with water for spraying, or a solution of neutral soap.—*M. C. C.*

Rhus, Species of. By W. T. (*Gard. Mag.* 2,509, p. 777; 30/11/1901).—A good descriptive account of the various kinds of Sumach

in cultivation, particular attention being directed to those best for ornamental planting. Notes on culture and position make the account valuable to those who are interested in these trees and shrubs.—*W. G.*

Rodriguezia decora, Rchb. f. (Cogniaux in *Dict. Icon. Orch., Rodr.,* pl. 1; 5/1901).—Discovered by Libon in the province of St. Paul, Brazil, and introduced by M. De Jonghe, of Brussels, and flowered first in 1851. *C. C. H.*

Roella amplexicaulis. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 400; 12/1901).—Description of new species from the Cape Peninsula *G. S. B.*

Rosa lævigata 'Anemone Rose' and R. macrantha. By S. Mollet (*Rev. Hort.* pp. 548-50; 12/1901).—Coloured plate showing both; very fine single roses. History of origin and description. *C. T. D.*

Rose 'Gottfried Keller' (*Die Gart.* p. 136; 21/12/1901; illustration).—A new Tea Rose, flowers almost single. The colour is apricot-yellow; centre, golden yellow; and margin, orange. Very vigorous and perpetual blooming.—*G. R.*

Rose 'Mark Twain' (*Amer. Gard.* xxii. p. 687; 5/10/1901).—H.T., free and vigorous, flowers rich satiny pink, with long pointed buds. Registered by the Soc. Amer. Fl. for Messrs. Peter Henderson & Co., of New York.—*C. C. H.*

Rose 'Mrs. Oliver Ames.' By Leonard Barron (*Amer. Gard.* xxii. p. 811, figs. 168, 169; 30/11/1901).—A new pink Rose becoming popular in the States; it has all the characters of its parent 'Mrs. Pierpont Morgan' except in colour, which is a bright light pink, shading to whitish-yellow at the base of each petal.—*C. C. H.*

Rose 'Mrs. Theodore Roosevelt' (*Amer. Gard.* xxii. p. 687; 5/10/1901).—H.T. of 'La France' type, free, strong, creamy-white shaded pink, very full. Registered by the Soc. Amer. Florists for Messrs. Peter Henderson & Co., of New York.—*C. C. H.*

Roses, a Classification of Noisette Forms. By P. Guillot (*Bull. Soc. Hort. Loiret*, tome vi. No. 15, p. 667; 1901).—The writer gives an account of the origin of these, and divides them into three groups:—

1. Showing influence of *R. indica,* with little of the Noisette character, better described as climbing teas. Ex. *Alister Stella Gray*, &c.
2. Hybrids of Noisette, white or pink only. Ex. *Boule de Neige*, &c.
3. True *R. Noisettiana*. Ex. *Aimé Vibert*.—*E. A. B.*

Roses and their Uses. By J. R Jackson (*Gard. Mag.* 2,510, p. 816; 7/12/1901).—The late Keeper of the Kew museums describes the various economic uses of the Rose, but chiefly the product known as Attar of Roses. The source of the attar, the species of Rose producing it, methods adopted in the various countries in cultivating them, the process of distillation, and other interesting details are given by the writer.—*W. G.*

Roses, Cuttings, Different Modes of taking. By Viviand Morel (*Rev. Hort.* pp. 442, 443, and 485, 486, 9/1901; and pp. 459, 460, 10/1901).—Continuation and conclusion of series of interesting articles commenced pp. 357–360, 8/1901.—*C. T. D.*

Roses, Giant. By R. du Parc (*Bull. Soc. Hort. Loiret*, tome vi. No. 18, p. 544; 1901).—Measurements of some Roses of remarkable size. A *Noisette Lamarque*, in California, trained on a wall, nineteen years old, 8 metres in height, 14 in length; a *R. Banksiæ* at Toulon covers a wall of 20 metres, 5 or 6 metres in height.—*E. A. B.*

Roses, Riviera Garden. By E. H. Woodall (*Gard.* p. 177; 14/9/1901; p. 227, 5/10/1901).—An exhaustive list of Roses grown in the Riviera, with notes upon each variety. Quite half of the varieties mentioned are almost, if not quite, unknown in English gardens.
E. T. C.

Roses, A Selection of New. By Philomel (*Gard.* p. 314; 9/11/1901; p. 346, 23/11/1901; p. 410, 21/12/1901).—The best of the new Roses announced since and including 1898, with a short description of each.—*E. T. C.*

Roses, Some of the Newer. By Herbert E. Molyneux (*Gard.* p. 288; 26/10/1901).—Short descriptive notes on Roses of more recent introduction that are worth growing.—*E. T. C.*

Roses under Glass. By John Denman (*Gard.* p. 485; 28/12/1901).—Practical notes dealing with Roses in pots and planted out, the best varieties for the purpose, and a note on Rose pests.
E. T. C.

Root-Gall. By W. A. Cobb (*Agr. Gaz. N.S.W.* p. 1,041–52; September 1901).—An interesting and exhaustive article with regard to this disease, dealing with its history and remedies for combating it. The article is illustrated with several woodcuts.—*A. W. S.*

Root-killing in Apple Trees (*U.S.A. Exp. Stn. South Dakota, Bull.* 65).—This pamphlet gives an account of the great mortality among Apple trees in severe winters in S. Dakota owing to the killing of the stocks by frost. The stocks used were seedlings of American and French varieties of *Pyrus Malus* and of *P. ioensis*, a native of Iowa. The extensive trial of *Pyrus baccata* as a stock is recommended, since this has proved hardy in parts of Russia where other species have perished. Five plates illustrate the amount of growth made by, and the rooting of, scions.
F. J. C.

Root Rot of Fruit Trees. By E. M. Willcox (*U.S.A. Exp. Stn. Oklahoma*, April 1901).—Probably the same disease as described six months previously as "Apple-root rot" with additional details. It is accompanied by great exudation of gum about the crown of diseased trees. It occurs on Peach, Cherry, and Apricot trees. Groups of Mushrooms are found about the base of the trees, but the observer gives no information

about them. The subcortical mycelium may give rise to the purplish-black rhizomorphic strands, which grow out into the soil to a considerable distance, in one case about ten feet. It was early found in these investigations that the disease is confined to those orchards that were planted on recently cleared timber land. It is added that the application of any fungicide, as a remedial agent, cannot be recommended at all.

M. C. C.

Sagittaria japonica flore pleno. Anon. (*Gard. Mag.* 2,509, p. 778; 30/11/1901).—A good illustration, with descriptive and cultural note, is given of this beautiful water-plant, the Japanese Arrow-head, which is but little known in gardens.—*W. G.*

Saintpaulia ionantha in the Open. By Ed. André (*Rev. Hort.* pp. 492, 493; 11/1901).—Two illustrations. Recommended for rockeries with north aspect in conjunction with Ferns and *Ramondia pyrenaica.* There are several varieties, rose, lilac, and blush-white.—*C. T. D.*

Salt-marsh Lands, Reclamation of. By Thos. H. Means (*U.S.A. Dep. Agr., Bur. Soils, Circ.* No. 8; 1901).—An inquiry was made into the feasibility of reclaiming the salt-marsh lands of the States which border the Atlantic or Pacific Ocean. Attention is drawn to the fact that the reclaimed salt-marshes of Europe are considered the most fertile of soils, and that in England probably more than 1,000,000 acres of fen lands have been successfully drained and are now in a most fertile condition.

Notes on the reclamation process, washing out the salt, and cultivation of marsh, together with the most suitable crops for assisting in the work, are given.

The agricultural value of the salt marshes, with tables of both chemical and mechanical analysis, is set forth. And it is quoted that "one acre of reclaimed marsh land is worth four or five acres of upland, and the cost of reclamation should not exceed one-fifth of the final value of the land."—*E. F. H.*

Salvia splendens, A Pure White (*Rev. Hort.* p. 466; 10/1901).—Raised by M. A. Fresneau, head gardener, Château de la Perraudière (Maine-et-Loire). A purer white than the white form hitherto known in France. Recommended as a decorative plant on account of its marked characters.—*C. T. D.*

Scale Insects. By Chas. E. Chambliss (*U.S.A. Exp. Stn. Tennessee,* vol. x. No. 4; 12/1897).—The following scale insects are illustrated, their history noted, remedial measures against their attacks indicated, together with an enumeration of their natural enemies:—San José Scale, Oyster-shell Scale, Scurfy Bark Louse, Rose Scale, Cottony Maple Scale, Grape Scale, and Peach Scale.—*F. J. C.*

Scale Insects—three common Orchard scales. By H. T. Fernald (*U.S.A. St. Bd. Mass.,* May 1901, with cuts).—Descriptions and life-history of the oyster-shell scale (*Mytilaspis pomorum*). The scurfy

scale (*Chionaspis furfura*) and the San José scale (*Aspidiotus perniciosus*), with suggestions for treatment with kerosene, crude petroleum, fumigation, and whale oil soap.—*M. C. C.*

Schomburgkia Humboldti, Reichb. f. (L. Linden in *Lind.* xvi. pl. 728; 1/2/1901).—A rare and beautiful species from Venezuela, first flowered in Europe in 1887. Flowers large and numerous, white tinted rose; lip dark crimson-purple, margined white, with rich yellow throat.
C. C. H.

Schomburgkia Thomsoniana, Rchb. f. (Cogniaux in *Dict. Icon. Orch., Sch.*, pl. 1; 11/1901).—Introduced from the island Grand Cayman of the Antilles in 1886. Flowers small, segments undulate, creamy-yellow, with maroon-purple lip.—*C. C. H.*

School Gardens. By F. M. Powell, M.D. (*U.S.A Hort. Soc. Iowa, Ann. Rep. for* 1899, p. 141).—An instructive and interesting paper, dealing with the subject mostly from a historic point of view. The writer starts with Italian cities at the beginning of the 14th century, where there were institutions in which plants were raised for purposes of education and science. Botanical gardens in European countries and the United States at the present day are referred to, and an appeal is made for the establishment of school gardens for the education of children.—*V. J. M.*

Schubertia grandiflora, Martius. By K. Schumann (*Gartenflora*, p. 561, pl. 1,492; 1/11/1901).—A coloured plate and short article on this South Brazilian climber belonging to the *Asclepiadaceæ*. The flowers are pure white, with a strong odour something like that of Jasmine. The plant requires treatment similar to that needed by *Stephanotis floribunda*. A short paragraph on its cultivation by Victor de Coene is given on p. 562 of same issue of *Gartenflora*.—*J. P.*

Seaside Planting. By G. Abbey (*Jour. Hort.* p. 531; December 12).—The writer gives instructions about this, founded on experience.
C. W. D.

Sebæa ochroleuca, gibbosa, and rara. By A. H. Wolley Dod (*Journ. Bot.* 468, pp. 400–1; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Seeds (*Woburn, 2nd Rep.* 1900, p. 210).—Experiments made with the germination of seeds from large and small fruits of Apple and Pear trees seem to show that neither the size of the fruit nor the number of seeds per fruit has any certain effect on the germinating power of the seed, and probably not on the vigour of the seedlings.—*C. H. H.*

Seeds, Growing and Saving Field and Garden. By F. S. White (*U.S.A. Hort. Soc. Iowa, Ann. Rep. for* 1899, p. 485).—A paper dealing with Corn seed and Potato seed principally, and concluding with other seeds. Some valuable advice is given, and the results of experiences in Iowa are described. Some useful hints upon seed storing. The writer when speaking of Potatos seems to have no fear of the old hard-shell Colorado beetle, but deals seriously with the black or brown Potato flea.
V. J. M.

Seeds, Longevity of Buried (*Amer. Gard.* xxii. p. 826; 7/12/1901). Prof. W. J. Beal has been experimenting with buried seeds of the commoner weeds, and the following among others have germinated after being buried 2 feet in clean sand for twenty-two years:—Mustard, Shepherd's Purse, Mallow, Evening Primrose, Dock, Chickweed, and Mullein.

C. C. H.

Selenipedium caudatum Wallisii, Rolfe (Cogniaux in *Dict. Icon. Orch., Seleniped.*, pl. 1A; 5/1901).—Discovered in 1865 by Wallis for Linden, in Peru. Flowers whitish, lined green and shaded rose.

C. C. H.

Silver-leaf in Peaches. By M. C. C. (*Gard. Chron.* No. 769, p. 220; September 21, 1901).—This disease, which is still a puzzle to all who have studied it, is described, and its affinity to the disease known in the United States as "The Yellows" is suggested, but no remedy for either complaint is known.—*G. S. S.*

Slug, The Pear and Cherry. By Walter W. Froggatt (*Agr. Gaz. N.S.W.* p. 1,063–78; September 1901).—These pests, as well as Australian Sawflies, are dealt with in a very able article, which is splendidly illustrated.—*A. W. S.*

Sobralia × Veitchii (L. Linden in *Lind.* xvi. pl. 740; 1/5/1901). A hybrid from *S. macrantha* and *S. xantholeuca*, first raised by Messrs. Veitch, of Chelsea, in 1894. This exquisite variety is from the collection of the Marquis de Wavrin. Sepals and petals creamy yellow, margined with pale rose; lip pale rose with rich yellow base.—*C. C. H.*

Soils, Preparing. By Geo. Macdonald (*Garden*, No. 1,573, p. 25; 11/1/1902).—The numerous sorts of soil—for instance, alluvial soil, clay soil, clay loam, loam, peaty soil, sandy soil—are classified, and a description of their composition given. The best methods of improving by cultural practice, and by the addition of natural and chemical manures, are also treated upon.—*E. T. C.*

Soldanella Species. By Prof. Dr. V. von Borbas (*Beih. Bot. Cent.* bd. x. ht. 4 and 5, pp. 279–283).—The author gives a key to and a short description of six species of *Soldanella*, including *S. alpina* and *S. montana*.—*G. F. S.-E.*

Soldanellas, The. By Henry Correvon (*Garden*, No. 1,579, p. 126; 22/2/1902).—A general description of this genus is given, followed by detailed notes upon each species. Interesting information is conveyed about the habits of these plants in their native Swiss Alps, and their culture is also treated upon. There are illustrations of *S. alpina*, *S. montana*, *S. pusilla*, and *S. minima*.—*E. T. C.*

Sorghum Syrup Manufacture. By A. A. Denton (*U.S.A. Dept. Agr. Bull.* 185; 1901; illustrated).—This bulletin deals almost exclusively with "the improving of the syrup by removing impurities from the juice," and more especially with a view to helping small manufacturers to improve the quality of their product.

After speaking of varieties, planting, cultivating, and harvesting the Sorghum plant, the writer goes on to describe four processes of clarification (suited to different-sized factories), the object of which is, in each case, " to remove solid impurities from the raw mill juice before heating the latter much, then to remove the impurities coagulated by heating the juice to boiling point, and finally to remove impurities which separate during concentration of the juice to 25° density."

The operations of filtering, skimming, evaporation, and settling are gone into, and the pamphlet concludes with a summary containing many useful hints to syrup-makers.—*C. H. C.*

Sparrows, Relations of, to Agriculture. By Sylvester D. Judd (*U.S.A. Dep. Agr. Bull.* No. 15, *Div. Biol. Survey*; 19 figs., 1 diag.).—A most interesting account of investigations undertaken during a course of years by the U.S.A. Biological Survey Department into the feeding habits of the various species of American sparrow. The English or European house-sparrow, which was misguidedly introduced into America about 1850, is, we are told, a most unmitigated nuisance, but all the native varieties are quite the farmer's friends, preferring weed-seed to grain, noxious to useful insects, and wild berries to garden fruit.

The writer lays stress upon the fact that, in calculating the comparative value or injuriousness of any bird to agriculture, it is as important to notice what he leaves as what he eats, and to this end it is necessary to carry on the investigations in three ways :—

1. By weighing separately the varying contents of a sufficient number of birds' crops to be able to decide, with approximate accuracy, on the relative proportions of useful to neutral and injurious matter devoured by the species.

2. By experimenting upon captive birds to find what food they will generally prefer and what they will entirely reject.

3. By carefully examining the available food supply in the birds' known feeding-grounds, so as to determine what they might have eaten and did not, and the proportions which they themselves established between the different articles of their diet.

The writer then takes each member of the sparrow family by name, gives an exhaustive account of its habitat and food, and sums up, more or less strongly, in favour of each, except in the case of Nuttall's sparrow, of which the usefulness seems doubtful, and of the English sparrow, which he entirely condemns.

He vindicates even the English sparrow, however, against the charge which has been brought against the whole family, of distributing weed-seed. A sufficient number of examinations have been made to show that the mutilation of the seed either in the beak or in the gizzard is so complete as to make germination later impossible.—*M. L. H.*

Spraying. By L. Mangin (*Bull. Soc. Hort. Loiret,* tome vi. No. 13, p. 569; 1901).—Directions for preserving evergreen plants from insects by spraying with solutions of sulphate of copper or naphthol.—*E. A. B.*

Spraying. By L. C. Corbett (*U.S.A. Exp. Stn. West Virginia University Bull.* 70).—For the prevention of scab on Apples, and also

for "Frog-eye" (*Phyllosticta pirina*), trials were made with Bordeaux mixture, applied at different periods before the leaf-buds and blossom-buds opened: *once* after the fall of the blossoms, and also *twice* after that event. Different varieties of Apple vary very much in their liability to be attacked by scab. Spraying before the opening of leaf-buds *only*, was not as good as spraying before the opening of leaf-buds, before the opening of blossom-buds, and *after* their fall; nor was this as successful as spraying before the opening of leaf-buds and blossom-buds, and *twice* after the fall of the blossoms.

The effect of spraying was a decrease in scab on leaf and fruit; the leaf consequently remained longer on the trees in the fall, and, as the leaves are the workshop of the plant, this is of great importance. The fruit did not drop as much as that on unsprayed trees, and it was much more free from "scab."

Codlin Moth.—The first brood is easily kept in check by the use of Paris green or London purple, applied immediately after the falling of the blossoms. Spraying is generally done at this period and ten days later, but in Virginia it is evident that the poison must continue to be used up to a much later date—probably as late as the middle of July—to destroy second and following broods. Arsenate of lead (11 oz. acetate of lead in one vessel, and 4 oz. arsenate of soda in another, when poured together form arsenate of lead, enough for 150 gallons of the spray), owing to its very fine division and remaining long in suspension, is found advantageous; it will also adhere well even to glossy leaves. It was used with Bordeaux mixture.

Combination of Contact and Poisonous Insecticide with a Fungicide. By means of a Kerowater-pump, kerosene was used from the oil pump at 10 and 15 per cent., from the main pump Bordeaux mixture with arsenical poison, used on April 26, and on May 12 and June 9; result, no injury from either the 10 or the 15 per cent. kerosene oil spray; well pleased with result; aphides did not appear on trees thus treated. On April 26, an Apple tree badly attacked by aphides was sprayed with 15 per cent. kerosene; aphides were all destroyed, tree not injured.

Mechanical Bordeaux Mixture.—To prevent the ill effects resulting from the standing of Bordeaux mixture after the combination of the lime and copper sulphate solutions, which make constant agitation necessary, two solutions were prepared in the usual manner, except that a concentrated solution of copper sulphate was used instead of a dilute one. This consisted of 2 lb. of copper sulphate in four gallons of water. Two pounds of lime was slacked and diluted with 12 gallons of water. The two solutions were then placed in the two receptacles of a Kerowater pump: the concentrated copper sulphate in the oil tank, and the 12 gallons of lime water in the barrel. The pump was then set to make a 25 per cent. mixture which combined the lime and copper sulphate in equal quantities in the nozzle. In appearance this solution was an ideal Bordeaux mixture. It distributed well, no clogging as a result of the combination of the lime and copper sulphate forming sulphate of lime. Its action, as far as could be judged from the season's tests, is in every way equal to that of standard Bordeaux mixture.

Tobacco.—Kerosene emulsion found very effective against Rose beetles.

The last twenty pages of this report deal with the treatment for San José scale and an essay on petroleum; for spraying purposes, petroleum with a high specific gravity is recommended.—*C. H. H.*

Stable Manure, Value of (*U.S.A. Dep. Agr. Bull.* 133, *Exp. Stn. Work*, xviii. 1901).—This valuable product is often wasted round Oklahoma. Not only is it not used by the farmers, but liverymen have to pay for it to be taken away. As an instance of its value, on one-half of an acre of land which had been in Wheat for eight years unmanured, the application of 15 tons of stable manure gave an increase of 18 bushels of Wheat the first year.—*C. H. C.*

Stangeria paradoxa, Th. Moore. By L. Graebener (*Die Gart.* p. 109; 7/12/01; with illustration).—Pretty Cycad, a native of South Africa. Before flowering and when for naming with only imperfect herbarium material it was named by Kunze *Lomaria coriacea*. And even Th. Moore, in 1851, called it the *Zamia* like Fern. Flowering in 1854, it was at once seen that it belonged to the *Cycadeæ*. Its leafage resembles more that of a Fern than the Cycas.—*G. R.*

Stapelia atrosanguinea. By N. E. Brown (*Gard. Chron.* No. 781, p. 425, December 14, 1901).—This distinct and somewhat remarkable species, from the Northern Kalahari Desert, introduced by Capt. Lugard in 1899, is fully described.—*G. S. S.*

Staphylea colchica (*Ann. Soc. Hé.* p. 55; March 1901).—A hardy shrub, good for forcing, is described and recommended.—*C. W. D.*

Stenorrhynchus speciosus maculatus (Cogniaux in *Dict. Icon. Orch.*, *Sten.*, pl. 1; 3/1901).—A curious terrestrial Orchid, otherwise known as *Spiranthes colorata*. Leaves marbled and spotted with silvery white; flowers red without, rosy-white within. The species is widely distributed over Central America, South America, Jamaica, and Cuba.—*C. C. H.*

Stœbe rosea. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 399; 12/1901).—Description of new species from the Cape Peninsula.—*G. S. B.*

Stone Fruits in West Virginia. By Hon. H. W. Miller (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 *and* 1900, p. 353).—A note dealing with the cultivation of stone fruits in this State. It is stated that they do well there, with the exception of the Apricot, which is too early in blooming to mature crops. The Peach is grown and shipped in refrigerator cars, the most satisfactory and cheapest method. The Plum is fully dealt with.—*V. J. M.*

Strawberries (*Woburn, 2nd Rep.* 1900, p. 85).—Eighty-six varieties from Europe and America tried in competition, results varying considerably with season, both as to comparative earliness and yield, so that no one particular Strawberry can be called the best for yield, earliness, flavour, or ability to stand carriage. So far the average crop for first, second, third, and fourth years are in the proportion of 81, 100, 122, and 132, the

fifth year showing no signs of diminution; the berries are largest in the first year. The comparative size at different ages was found to be 15, 4, 5, and 9 for the fourth and fifth years, and the estimated value of crop was proportionately 84, 100, 117, 111, and 110 for first, second, third, fourth, and fifth years.

The earliest berries are chiefly found on one-year-old plants, being ripe 2½ days previous to those on older plants. Average yield per acre varied in different seasons from 1 to 1¼ tons.

From manurial experiments on Strawberries the conclusion arrived at was that natural dung increases the crop to a certain extent, whereas artificial manure does not, and that a moderate dressing of the former gives almost as good a result as a heavy one.

Liquid manuring, in four instalments, once a week during the swelling season, at about one quart per plant, water alone, also solutions of 3·96 lb. ammonium sulphate, 5·87 lb. sodium nitrate, 6·98 lb. potassium nitrate, and 3·96 lb. ammonium sulphate, with 1·65 lb. of iron sulphate, to plots of 528 plants at 2 ft. apart, or 0·0485 of an acre: none of these treatments gave marked results. As to distance of plants from each other, 1½ ft. × 1½ ft. gave better results than 1 ft. × 1 ft.—*C. H. H.*

Strawberry, Packing of the. By J. M. Buisson (*Rev. Hort.* pp. 470–472, 10/1901; and pp. 507, 508; 11/1901).—Fifteen woodcuts. Two interesting and well-illustrated articles showing modes of packing for transport in various parts of France.—*C. T. D.*

Strawberries, Perpetual. By H. Dauthenay (*Bull. Soc. Hort. Loiret*, tome vi. No. 13, p. 581; 1901).—An account of, as shown at the Paris Exhibition, proving 'St. Antoine of Padua' to be the best variety.
E. A. B.

Strawberries, Resistance to Frost (*U.S.A. Dept. Agr. Bull.* 133; *Exp. Stn. Work*; 1901).—As a result of experiments it was found that certain varieties of Strawberries suffered less from late spring frosts than others; more especially was this the case with those in which the achenes or seeds are deeply embedded in the succulent tissue.

Short fruit-stalks and long leaf-stalks proved also to some extent a safeguard.—*C. H. C.*

Suæda cæspitosa. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 401; 12/1901).—Description of new species from Paarden Island, Cape Colony.
G. S. B.

Sugar Beets (*U.S.A. St. Bd. West Virginia, Rep. for* 1899 *and* 1900, p. 269, 4 plates).—A note upon the results of experiments in Sugar Beet growing in the United States. The writer shows, as a result of actual experiments, of which statistics, analyses, and photographs are given, that light has a considerable effect upon the development of saccharine matter in the Beet.—*V. J. M.*

Sugar Beets in South Dakota. By J. H. Shepard and W. H. Knox (*U.S.A. Exp. Stn. S. Dakota*, February 1899; with cuts).—

Containing directions for Sugar Beet culture, and the results of experiments during 1898, with cost per acre and analysis of produce.—*M. C. C.*

Sundials. By G. Gordon (*Gard. Mag.* 2,510, p. 789; 7/12/1901).—Interesting article on sundials of various countries, with historic notes of the more famous examples. Excellent illustrations are given of the sundials at Glamis Castle, Beechfield, Claverton Manor, and the Wilderness, Box, the three last named being beautiful in design.—*W. G.*

Superstitions. Anon. (*Bull. Soc. Hort. Loiret*, tome vi. No. 13, p. 550; 1901).—An amusing and interesting account of various prejudices and superstitions relating to plants in practice previous to the eighteenth century. Some of the instructions for mixed grafting, &c., to obtain stoneless varieties of fruit and other desirable but unlikely results, are more creditable to the patience and faith, than the power of criticism, of those ages.—*E. A. B.*

Thermometers, The Use of. By Edward Mawley (*Garden*, No. 1,578, p. 106; 15/2/1902).—The gardener who takes note of the weather has an advantage, and the writer of this article tells how meteorological observations may be taken. The various forms of thermometers are described and how to use them. The subject of rainfall also receives attention, and instructions are given as to registering it by means of the raingauge.—*E. T. C.*

Thrips in Greenhouses. By W. E. Hinds (*Proc. 17th Annual Convention Soc. Amer. Florists*; Aug. 1901, with fig. 2).—Description of a small species of thrips, *Thrips tabaci*, first made known in 1888 as doing immense injury to the tobacco crop in Russia. In the United States its depredations have been chiefly confined to Onions, but it also selected Cabbages and Strawberries, and at length has found its way into greenhouses. The remedy experimented with has been the vaporisation of "Nikoteen," a tobacco product manufactured in Chicago. Nearly all the thrips were killed.—*M. C. C.*

Thrips on Cacao. By H. Maxwell Lefroy (*Jour. Imp. Dep. Agr. W.I.* vol. ii. No. 3, p. 177).—The Cacao trees of Grenada are threatened with an invasion of thrips. At present no very great damage has been done, but should the pest increase the industry may be destroyed. The article is of much value for any in other parts of the world who suffer heavily from thrips. It has also a general value from the recipes which it gives, with directions for use, of various different emulsions and washes which have been found effective.—*W. W.*

Tillandsia Duratii, Vis. By L. Wittmack (*Gartenflora*, p. 452, fig.; 1/9/1901).—A photograph and brief notice of this epiphyte.—*J. P.*

Tobacco. The Stalk Worm, A new Enemy to young Tobacco. By Prof. W. G. Johnson (*U.S.A. Hort. Soc. Maryland*, vol. ii. 1899, with figs.).

Treats of the ravages of the larva of *Crambus caliginosellus* on young Tobacco plants. In one field about 22,000 plants had been destroyed by it. Experiments are being made to check its increase and mitigate its injuries. Temporarily it is advised not to plant Tobacco upon grass, timothy, or clover soil.—*M. C. C.*

Togo Rubber (*Not. König. Bot. Berlin*, No. 27, p. 184, Oct. 1901).—Notes by Gruner on certain caoutchouc-yielding Lianas, *Kickxia*, &c., growing in the Togo region, near Dahomey, West Coast of Africa.
H. M. W.

Tortrix, The Plum-tree Boring (*Sesamia Wœberana*, Autor). Anon. (*Jour. Bd. Agric.* vol. viii. No. 2, pp. 165–167, with illustrations).—The treatment suggested for this common bark-feeding moth is as follows: "Little can be done to prevent this pest, but probably smearing cart-grease round the trunk, or, better still, a mixture of grease and paraffin, from the ground some way upwards, during the middle of May would prevent egg-laying, another application being made in September when the season brood are egg-laying.

"When once under the bark little can be done. The openings of the tunnels may be found on clearing away the 'frass,' and a wire inserted up the cavity, or a knife forced in, so as to kill the larvæ during the winter. Where only a few trees are attacked this is perhaps the best mode of treatment; on a large scale, smearing the diseased spots with grease and strong paraffin and rubbing it well in after the 'frass' has been brushed off might be tried with possible benefit."—*R. N.*

Tree-planting on Rural School Grounds. By Wm. L. Hall (*U.S.A. Dept. Agr. Bull.* 134; 1901; illustrated).—A bulletin dealing with the present condition and needs of rural school grounds in the States, and indicating methods for their improvement, chiefly in the direction of more tree-planting on judicious lines.

The kind and character of trees to plant, the time and manner of planting, after-care and management, and studies for the teacher and school, are among the contents.—*C. H. C.*

Trichopilia tortilis, Lindl. (Cogniaux in *Dict. Icon. Orch.*, *Tric.*, pl. 6; 11/1901).—Introduced from Mexico and Guatemala in 1835. Sepals and petals twisted, purple-brown, margined yellow; lip large, white, spotted with purple-brown at the base.—*C. C. H.*

Trichocentrum albo-purpureum, Lind. and Rchb. f. (L. Linden in *Lind.* xvi. pl. 748; 15/9/1901).—Introduced from Brazil by Jean Linden in 1864. Sepals and petals yellow without, brown within; lip white, with two large purple areas at base, and lined with purple towards apex.
C. C. H.

Trillium. By A. B. Rendle (*Journ. Bot.* 466, p. 321; 10/1901).—Notes, chiefly on the specimens in the British Museum Herbarium, with descriptions of two new species, *T. Rugelii*, collected in North Carolina in 1841, and *T. affine*, from Georgia.—*G. S. B.*

Tritomas. By S. Mottet (*Rev. Hort.* pp. 577–580; 12/1901). With six illustrations of various species and descriptions of varieties.—*C. T. D.*

Tulips, Rembrandt. By Jules Rudolph (*Rev. Hort.* pp. 481, 482; 10/1901).—A striped-flowered section raised from the 'Darwin,' by MM. Krelage & Son, Haarlem. More robust, nearly 2 feet high, late flowering and permanent.—*C. T. D.*

Ule's Expedition to the Caoutchouc Region of the Amazon River (*Not. König. Bot. Berlin*, 22, p. 129, Oct. 1901).—Notes on *Hevea brasiliensis* and other species of *Hevea, Sapium, Castilloa,* and rubber-yielding trees.—*H. M. W.*

Valerianaceæ and Dipsaceæ, The Relationships of. By F. Höck (*Engl. Bot. Jahrb.* xxxi. pp. 405–411; 10/12/1901).—A brief criticism of the subdivision and mutual affinities of the two orders, arising from a consideration of the closely allied genera *Hoeckia* and *Triplostegia*, which are to be regarded as forming a tribe of *Valerianaceæ*, but representing a connecting link with the *Dipsaceæ*, for which the name *Scabiosaceæ* is suggested as more suitable.—*A. B. R.*

Vanda cœrulescens, Griff. (Cogniaux in *Dict. Icon. Orch., Vanda*, pl. 18; 5/1901).—Discovered in Burma by Griffith in 1837, and introduced by Colonel Benson in 1867. Sepals and petals lilac-blue; lip violet; flowers small.—*C. C. H.*

Vanda × 'Miss Joachim,' Ridley (Cogniaux in *Dict. Icon. Orch., Vanda* hyb., pl. 1; 11/1901).—A hybrid obtained by Miss Joachim at Singapore in 1893, out of *V. teres* by *V. Hookeriana*. Sepals and petals rose, lateral sepals paler or white; lip purple-rose shaded violet, with yellow base.—*C. C. H.*

Variation and Environment. By C. T. Druery (*Gard. Chron.* No. 781, p. 433, December 14, 1901).—Various theories as to the influence of environment on variation are discussed and commented on.—*G. S. S.*

Variegation, Numerous associated Instances (*Rev. Hort.* p. 448; 10/1901).—The Directors of La Carrosaccia, at Ajaccio, Corsica, report the appearance among their cultures of a striated *Adiantum cuneatum*, a *Kentia Forsteriana* with one striated leaf, a striated *Begonia semperflorens Vernon*, leaves occasionally all white, and five plants of *Wistaria sinensis*, in one sowing, all with yellowish white leaves, which, however, become green later as the plants mature. The silico-schistose nature of the soil is suggested as cause, but the late Mr. G. B. Wollaston was a strong believer in variegation being contagious by root anastomosis, and has shown me associated plants of different genera, which he declared had so originated.—*C. T. D.*

Varieties, New, The Art of obtaining. By Viviand Morel (*Rev. Hort.* p. 568; 12/1901).—A practical work in this direction.—*C. T. D.*

Vegetable Constituents. By F. E. H. W. Krichauff (in *Fertilising Field and Garden*, p. 88).—The author states that in a fresh condition a ton (2,240 lb.) of the following contains in pounds the undermentioned constituents :—

Vegetable		Dry Substance	Nitrogen	Ash	Water	Potash found in Ash	Phosphoric Acids in Ash
Asparagus . .	lb.	150	7	11	2,072	3	2
Cabbage, Head of .	,,	224	6	21	1,989	10	4
,, Stem of .	,,	246	5	35	1,954	13	3
Carrots, Roots of .	,,	336	5	18	1,881	7	3
,, Leaves of .	,,	399	1	54	1,776	6	2
Celery	,,	356	5	39	1,840	17	5
Lettuce	,,	134	5	18	2,083	8	2
Onions	,,	314	6	17	1,903	5	3
Peas, Seeds and Pods of	,,	1,919	80	52	189	23	19
,, Vines of . .	,,	1,881	23	97	239	22	8
Potatos, Tubers of .	,,	515	8	21	1,696	13	4
,, Haulms of .	,,	1,919	11	44	266	22	8
Turnips	,,	—	3 lb. 12 oz .	—	—	1 lb. 6 oz.	6 lb. 6 oz.
,, Leaves of .	,,	—	2 lb. 14 oz .	—	—	11 oz.	2 lb. 6 oz.
Swedes	,,	—	5 lb.	—	—	1 lb. 3 oz.	4 lb. 9 oz.
,, Leaves of .	,,	—	2 lb.	—	—	5 oz.	1 lb. 2 oz.

C. H. H.

Vegetables. By L. C. Corbett (*U.S.A. Exp. Stn. W. Virg. Bull.* 49, 1897).—Chiefly concerned with statistics of varieties of Lima Beans and Tomatos cultivated, with comparative values of the varieties.

M. C. C.

Vegetables, Exhibition. By Edwin Beckett (*Garden*, No. 1580, p. 142; 1/3/1902).—A practical article, continued in several successive numbers, upon the culture of vegetables for exhibition. The preparation of the land, rotation of crops, quality of vegetables *versus* size, the best varieties to grow, staging the exhibits, and detailed cultural directions for each vegetable make up a valuable paper.—*E. T. C.*

Vegetation of the Carolines, with special reference to that of Yap. By G. Volkens (*Engl. Bot. Jahrb.* xxxi. pp. 412-477, tt. xi.-xiv.; 10/12/1901).—The author gives a short general account of the islands which he visited in 1899 and 1900, including a detailed description of the geology, climatology, and vegetation of Yap, where he spent seven months. The island is three miles long, one-and-a-half broad, and includes a mangrove and sea-shore vegetation of the usual Indo-Malayan character. The flora of the high lands, however, is apparently of an older character, and has an eastern and south-eastern origin.—*A. B. R.*

Veronica. By Rev. C. Wolley-Dod (*Garden*, No. 1,574, p. 40, 18/1/1902; No. 1,575, p. 56, 25/1/1902; No. 1,576, p. 66, 1/2/1902; and No. 1,577, p. 92, 8/2/1902).—The introduction deals with the nomenclature of this genus and its early history. Subsequent chapters contain descriptions of a number of select species as cultivated in the garden at Edge Hall. There are interesting remarks with reference

to their culture, the hardiness of the various species, their hybridisation, &c.—*E. T. C.*

Viburnums. By W. J. B. (*Gard. Chron.* No. 775, p. 820, fig. 100, and a supplemental plate ; November 2, 1901).—Thirty species belonging to this genus are said to be in cultivation at Kew, but many have no special value for private gardens. Notes on nine of what the author considers the "best as ornamental shrubs" are given.—*G. S. S.*

Viburnums. By G. Gordon (*Gard. Mag.* 2,505, p. 707 ; 2/11/1901). An account of the cultivated species of Guelder Rose, deciduous and evergreen. Illustrations are given of *V. tomentosum plicatum*, *V. Tinus hirtum*, and *V. Opulus*.—*W. G.*

Vine Disease, A. By F. Noack (*Gartenflora*, p. 619, 1/12/1901). An account of a disease observed in a vinery at Darmstadt last summer. Pale spots are noticed on the berries when half-ripe. Later the spots turn brown and leathery, and on cutting open the grape the flesh is seen to be dead and dry at those points. The spots occur on the sides of the fruit away from the light, and where the berries touch each other.

On both sides of the leaves, but chiefly on the lower surface, are very minute wart-like intumescences, which at first are green but afterwards become brown, and then somewhat resemble the sori of a rust fungus. These protuberances arise from the abnormal growth of some of the cells beneath the epidermis of the leaf.

The disease was caused by a high temperature and insufficient transpiration. Syringing increased the trouble.—*J. P.*

Vine, Diseases of (*Rev. Hort.* p. 397 ; 9/1901).—Sheets of chromographic pictures illustrating effects of numerous diseases, facilitating diagnosis and cure by remedies given in the margin. Published by M. Gabriel Perdoux, Bergerac (Dordogne), fcs. 3, 26" × 20".—*C. T. D.*

Wahlenbergia depressa. By A. H. Wolley Dod (*Journ. Bot.* 468, p. 400 ; 12/1901).—Description of new species, allied to *W. montana*, from Lion's Head, Cape Peninsula.—*G. S. B.*

Walnuts. By W. J. B. (*Gard. Chron.* No. 776, p. 334 ; November 9, 1901).—Notes are given of five species belonging to the genus *Juglans* which are worth cultivating as ornamental trees.—*G. S. S.*

Water Melons and Musk Melons in South Dakota. By N. E. Hansen (*U.S.A. Exp. Stn. S. Dakota Bull.* 67, April 1900 ; with cuts). Consisting chiefly of elaborate tables of numerous American and foreign varieties, showing size, surface, shape, and colour, with remarks. Of Water Melons 100 American and 59 imported varieties, and of Musk Melons 158 American and 90 imported varieties, were planted, and are reported upon.—*M. C. C.*

Weed Killer, Electrical. Anon. (*Agr. Jour. Cape G. H.* vol. xix. No. 5, p. 389).—"The Illinois Central Railroad has been testing a new

method of killing weeds. A brush heavily charged with electricity runs along about eight inches from the ground, and every weed with which it comes in contact, however strong or large, is immediately killed and turns black as if frozen. It formerly cost the company $40 per mile to kill the weeds alongside the track, but with the electric brush they can kill five miles an hour at very small expense."—*Country Gentleman.*—*R. N.*

Weeds. By J. W. Blenkenship (*U.S.A. Exp. Stn. Montana, Bull.* 30; 6/1901; 21 figs.).—This pamphlet, after some remarks on weeds in general and on the means to be employed in order to eradicate them, gives an annotated list of the 134 weeds of Montana, of which ninety-three are said to have been introduced and forty-one only native.—*F. J. C.*

Weevil, Apple Blossom. By Alger Petts (*Gard. Mag.* 2,511, p. 829; 14/12/1901).—The life-history of this insect pest is described in a clear way, and the various measures for its eradication and prevention given.—*W. G.*

Wheat Growing in the Pacific Coast Regions of the United States. By Edwin S. Holmes, jun. (*Bull. No.* 20, *U.S. Dep. Agr.*).—A splendid treatise on wheat-growing in the regions of the Pacific Coast, located in the States of California, Oregon, Washington, and Idaho. It is pointed out that the first impression made on the Eastern visitor by observation of the farming methods in vogue in this region is that there is a total difference between them and those to which he has been accustomed in the East. Methods which give the very best results in the East would often be totally worthless on the Pacific Coast, and consequently, owing to its peculiar natural conditions and resources, the Pacific Coast region has a farming system which is distinctly its own. The pamphlet deals with the size of farms, farming for single crops, non-production of food, farm machinery, disposal of straw, farm buildings, temperature and rainfall. area devoted to wheat, varieties of wheat, &c. It is illustrated with several reproductions from photographs of remarkable ploughing and threshing scenes.—*A. W. S.*

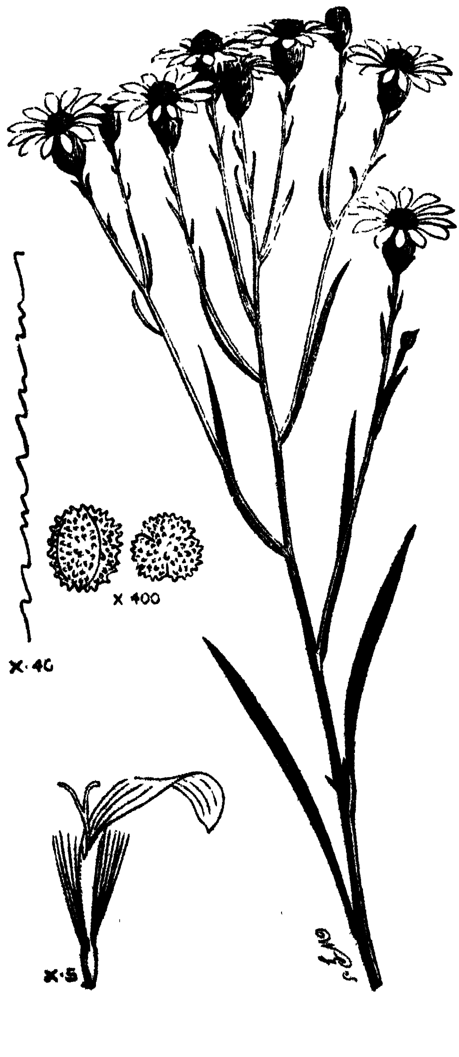
Winter of 1900–1901 in the Garden of the "White House." By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 10, p. 289; October 1901). An account of the effects of severe cold upon plants belonging to warmer climes, which Baron Giovanni Ricasoli Firidolfi is endeavouring to acclimatise in his garden. Most plants, although they suffered severely, yet vegetated freely the following spring. Cycads slightly sheltered by covering, under which, however, the thermometer fell to zero and even one degree below, were quite uninjured.—*W. C. W.*

Worms of the Garden and Lawn. By H. Friend (*Gard. Chron.* No. 774, p. 310; October 26, 1901).—The first of a series of papers on these well-known creatures. There appear to be no less than twenty-five different species of earthworms in this country, of which only ten or twelve are commonly found in gardens and lawns. They belong, with one exception, to two genera, *Lumbricus* and *Allolobophora.* The points of difference between the two genera are given in a tabular form.—*G. S.-S.*

Zygopetalum Burti Wallisi, Veitch. (L. Linden in *Lind.* xvi. pl. 745; 15/9/1901).—This plant is generally known as *Batemania Wallisi,* discovered in Costa Rica in 1867, and first flowered here in 1872. The variety figured has large flowers, rich red-brown striped with purple, with yellow and white base; column pure white, tinged with red beneath.
C. C. H.

Zygopetalum × Clayi, Rchb. f. (L. Linden in *Lind.* xvi. pl. 741; 1/7/1901).—A hybrid raised in 1877 by Colonel Clay, of Birkenhead, between *Z. crinitum* and *Z. maxillare.* Sepals and petals brown-purple, margined and lined with green; lip violet-blue lined with purple.
C. C. H.

Zygopetalum rostratum, Hook. (Cogniaux in *Dict. Icon. Orch., Zygo.,* pl. 4; 3/1901).—Originally described in 1828. Native of British Guiana and North Brazil. –*C. C. H.*



EXTRACTS FROM THE PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY.

GENERAL MEETING.

JANUARY 15, 1901.

Mr. ALEXANDER DEAN, F.R.H.S., in the Chair.

Fellows elected (58).—R. Archer, Edward Ardley, Charles Bailey, M. J. Barrington-Ward, M.A., F.L.S., Herbert Bensted, E. P. Bentfield, Michael Bermingham, Rev. Hugh A. Berners, M.A., Horton Bolitho, Lady Buckley, W. R. Burgess, G. M. Burlinson (New Zealand), George A. Cave-Orme, Miss Coe, William Davis, Edwin J. Day, J. Dickson, A. E. Dixon, Janson Fears, George Fowler, John T. Gardner, George H. Garrett, J.P., Courtney Hallett, Lady Hamilton, Edwin John Hammersley, William T. Holland, Mrs. G. A. Hornsby, Countess of Ilchester, Hugh Kerr, Colonel F. Kilgour, E. Dawson King, John Knight, D. C. Lathbury, C. H. Mayo, C. T. Moore, James S. Murray, Mrs. Sheffield Neave, Charles G. A. Nix, W. Northover, J. B. Oldham, Alex. M. Paterson, Mrs. Kendrick Peck, Eden Phillpotts, Herbert Roper, James Rose, Mrs. T. Schneider, H. J. Stobart, B.A., John Taylor, H. C. Tillard, Herbert Trenbath, Mrs. Turner-Farley, Theodore Vasmer, Miss Mabel Watson.

Associate (1).—George Wassell.

Societies affiliated (4).—Bewdley and District Horticultural Society, Douglas Horticultural Society, National Auricula and Primula Society (Southern Section), Thornton Heath and District Horticultural Society.

A paper on "Recent Developments in the Treatment of Diseases and Insects injurious to Orchard Crops," by Professor Beach, U.S.A., was read by the Secretary. (See p. 68.)

GENERAL MEETING.

JANUARY 29, 1901.

Mr. JOHN T. BENNETT-POË, F.R.H.S., in the Chair.

Fellows elected (14).—Frederick T. Bloxam, Mrs. William Brand, Miss Fletcher Campbell, Major Henry Doherty, Mrs. Harris, Mrs. Luckhurst, Dr. Gerald T. Moody, John Parker, Ethelbert Lort Phillips (Norway), Adolph Riekmann, W. N. Sloane, Lady Smyth, Colonel Thomas Todd, William Wainwright.

A lecture on some of the plants exhibited was given by the Rev. Prof. Geo. Henslow, M.A., V.M.H. (See p. 111.)

At a meeting of the Council held this day the President moved, and it was unanimously resolved: "That an Address of Condolence be sent to His Majesty King Edward VII. on the occasion of Her late Majesty Queen Victoria's death, and that a wreath be sent to Her Majesty's funeral."

In pursuance of this resolution a wreath was sent by special messenger to Windsor by Messrs. Wills & Segar, and the following Address was forwarded by the President to the Home Office:—

117 Victoria Street,
London, S.W.:
Feb. 4, 1901.

WE, Your Majesty's loyal and dutiful subjects, the Council of the Royal Horticultural Society, humbly approach Your Majesty with an expression of our deep and enduring sorrow at the grievous loss which has overtaken your Majesty in the death of our beloved and venerated Queen and Empress, Patron of our Society—a loss felt to be irreparable by every subject throughout the Empire.

Furthermore, we most respectfully beg leave to congratulate Your Majesty upon your accession to the Throne of your ancestors, and to wish Your Majesty most heartily a long, happy, and prosperous reign.

Signed on behalf of the Council,

TREVOR LAWRENCE,
President.

ANNUAL GENERAL MEETING.

FEBRUARY 12, 1901.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

The Minutes of February 13, and July 3, 1900, were read and signed.

Fellows elected (42).—Arnold B. Adams, John Basham, jun., Gardner S. Bazley, William Beale, James Blinkhorn, Ernest W. Brigstock, Mrs. Cameron, Mrs. Campion, F. G. Courthope, J.P., Arthur R. Goodwin, J. E. Moore Gwyn, J.P., Lawrence C. Higgins, Miss Hopkins, W. T. Jay, Spencer B. Kendall, T. Key, Owen E. Knatchbull, Charles R. Marcham, F. B. McTier, Miss Constance Miller, George Miller, I. m. Mitter (India), Henry G. Morgan, Thomas Neighbour, Mitchell Nicoll, H. Peerman, Hon. A. Pennington, Mrs. Pennington, Mrs. Bentham Rae, Chas. M. Rassell, George F. Roumieu, J.P., Mrs. H. Sanderson, John F. Spencer, Miss Staveley, John Stephens, A. B. Herbert Story, Charles Tickell, Hon. Mrs. Townshend, W. Unwin, Baron Dickenson Webster, Miss C. Welch, Frederick A. Wood.

A vote of thanks to the retiring Members of Council, F. Du Cane Godman, Esq., F.R.S., and Dr. Hugo Müller, F.R.S., was proposed by Mr. H. J. Elwes, V.M.H., F.R.S., and seconded by Dr. Masters, F.R.S., and carried unanimously.

The President moved the adoption of the Report, which will be found below. This was seconded by Sir John Llewelyn, Bart., and carried unanimously.

The President read the names of the proposed new Members of Council, Vice-Presidents and Officers, and declared the same duly elected, viz.:—

As new Members of Council:—Captain G. L. Holford, C.I.E., Rev. Hugh A. Berners, M.A., H. B. May, Esq.

As Vice-Presidents:—The Right Hon. Joseph Chamberlain, M.P., the Right Hon. the Earl of Ducie, the Right Hon. Lord Rothschild, Baron Sir Henry Schröder, Bart., V.M.H., Sir Frederick Wigan, Bart.

As Officers:—Sir Trevor Lawrence, Bart., V.M.H., *President*; J. Gurney Fowler, Esq., *Treasurer*; Rev. W. Wilks, M.A., *Secretary*; Alfred C. Harper, Esq., *Auditor*.

Mr. James Wigan asked if anything could be done to make the audience attending the Fortnightly Lectures more comfortable.

A vote of thanks to the Chairman was moved by Mr. Geo. Gordon, V.M.H., and seconded by the Rev. Professor Henslow, V.M.H., and carried unanimously.

REPORT OF THE COUNCIL

FOR THE YEAR 1900.

1. The past year marks an era in the history of the Society. The New Charter, the third granted since the foundation of the Society, having received the assent of Her Most Gracious Majesty the Queen, came into force at the commencement of the year, and the first business which engaged the attention of the Council was the formulation of new Bye-laws suitable to the same. The work was necessarily a long one; but at a General Meeting of the Society held on July 3 the Bye-laws as printed on pages 423 to 436 of Volume xxiii. of the Society's JOURNAL were formally adopted.

2. A corrected list of the awards made by the Society to plants, flowers, fruits, and vegetables to the end of 1899 has been issued during the past year. It has involved a great deal of labour and research, and the thanks of the Society are due to those gentlemen who assisted in the work, especially to those who prepared the section which deals with Orchids. The price of the entire volume has been fixed at 5*s*. (or the Orchid section can be obtained *interleaved* at 5*s*.), and the Council hope that many Fellows will take advantage of the information it contains in order to meet the unavoidably heavy expense incurred in its publication.

3. Under the head of ordinary expenditure at Chiswick, £1,817 has been spent on the general work and maintenance of the Gardens. The receipts by sale of surplus produce amount to £337, making the net ordinary cost of the Gardens £1,480.

4. The Council wish to call attention again to the good work done at Chiswick under Mr. Wright's superintendence, not only in the Garden but among the students. During the last three years, for example—of our

Chiswick students, one has taken a First Class in Honours in Science and Art, one a First in Advanced Botany, two a First in Elementary Botany, at South Kensington; one has been appointed Curator of the Botanic Gardens at Antigua; one is a Botanical Collector for the London School Board; eleven have taken a First Class in the R.H.S. Examination in Horticulture; five have set up in business for themselves; four have obtained positions at the Royal Gardens, Kew; one at Kensington Gardens; two at large private gardens; six in large nursery gardens; one is studying at the Royal College of Science, South Kensington; one is Editor, and another is on the editorial staff of a garden paper. Mr. Wright reports to the Council: "The demand for energetic trustworthy young men from Chiswick is rapidly increasing; there is no difficulty in placing such in good situations, our supply being unequal to the demand, but they *must all be workers.* During the past year applications were received for twenty-eight head gardeners, three single-handed gardeners, six foremen, and ten journeymen."

5. At Westminster, twenty-four Fruit and Floral Meetings have been held in the Drill Hall, Buckingham Gate, Victoria Street, besides the larger Shows in the Temple Gardens on May 23, 24, and 25; at Richmond on June 27; and at the Crystal Palace on September 27, 28, and 29. Lectures and demonstrations have been delivered at twenty of the meetings.

6. The number of awards granted by the Council, on the recommendation of the various Committees, will be seen from the following table:—

Award	Provincial Show	Purchased by Affiliated Societies	Temple Show	Sherwood Cup Competition.	Crystal Palace Fruit Show	On Recommendation of: Fruit Committee	Floral Committee	Orchid Committee	Narcissus Committee	Total
Gold Medal	2	—	5	—	2	2	4	3	—	18
Silver Cup	—	—	21	1	—	—	—	—	—	22
Hogg Memorial Medal	1	—	—	1	2	—	—	—	—	4
Silver-gilt Flora	2	—	21	—	—	—	21	4	—	48
Silver-gilt Knightian ...	—	—	2	—	2	16	—	—	—	20
Silver-gilt Banksian ...	2	—	—	—	2	—	31	—	—	35
Silver Flora	3	11	17	—	—	—	58	27	3	119
Silver Knightian	1	—	3	2	1	19	—	—	—	26
Silver Banksian	3	39	8	—	—	14	90	20	4	178
Bronze Flora...	—	13	—	—	—	—	15	—	—	28
Bronze Knightian ...	—	—	—	—	—	—	—	—	—	—
Bronze Banksian... ...	—	23	—	—	—	—	19	1	—	43
First-class Certificate...	2	—	6	—	—	8	14	34	4	68
Award of Merit	1	—	32	—	—	39	159	61	11	303
Botanical Certificate ...	—	—	4	—	—	—	6	44	—	54
Cultural Commendation	—	—	2	—	—	27	1	16	—	46
Total...	17	86	121	4	9	125	418	210	22	1012

In addition to the above, a Silver-gilt Flora Medal was awarded to Miss E. Welthin Winlo for having passed first in the Society's examination. Ninety-five Bronze Banksian Medals have also been granted to Cottagers' Societies.

7. The Council desire to draw the attention of Fellows of the Society to the more extended use which the Scientific Committee might be to them if they availed themselves more freely of their privileges in submitting instances of diseases of or injuries to plants caused by insects or otherwise. The Scientific Committee is composed of gentlemen qualified to give the best advice on all such subjects, either in respect to the prevention or cure of disease. The Committee is also glad to receive specimens of any subjects of horticultural or botanical interest.

8. The Society's Great Show held in May (by the continued kindness of the Treasurer and Benchers) in the Inner Temple Gardens was as successful as ever, and it is a matter of satisfaction to the Council to find that this Meeting is universally acknowledged to be the leading Horticultural Exhibition of this country. The best thanks of the Society are due to all who kindly brought their plants for exhibition, or otherwise contributed to the success of this Show.

9. The Exhibition of British-grown Fruit held by the Society at the Crystal Palace on September 27, 28, and 29 was, from an educational point of view, most satisfactory. Full particulars will be found in Vol. xxv., Part 3, of the JOURNAL, which will be issued in the course of a few weeks.

10. As an object-lesson in British fruit cultivation this annual Show stands unrivalled, and is of national importance. Those who have visited it from year to year cannot fail to have been impressed by the wonderful advance which has been made in the quality of the hardy fruits exhibited. And as the importance of fruit growing in this country cannot well be over-estimated, the Council invite Fellows and their friends to support them in their efforts to maintain and improve this Exhibition by visiting it, and by subscribing to its funds. For it cannot be too widely known that the continuance of the Show is absolutely dependent on at least £100 being raised by subscription each year towards the Prize Fund. The Show involves the Society in a very large expenditure without the possibility of any financial return. The Council cannot therefore continue it unless sufficient interest in it is taken by Fellows and their friends to provide £100 towards the Prize Fund. And this will in coming years be even more important than heretofore, as the Directors of the Palace have signified to the Council that they feel compelled to decrease their contribution by £50. A glance at the list of subscribers will show how small has been the interest taken by the bulk of the Fellows. The Council would point out that this is not a local Show with a few large prizes, but that a large number of small prizes have been provided in order to secure the best fruits in each section; special prizes have been allotted to market growers; and counties have been grouped in such a way that growers should not have to compete with exhibitors from localities more favoured by climatic conditions. These points will be still further extended should sufficient financial support be forthcoming. Subscriptions should be sent at once to the Secretary, 117 Victoria Street, Westminster, and if the list prove satisfactory the Schedule will be issued in April, and the Show held on October 10, 11, and 12, 1901. The list of subscribers for 1900 will be found at page 188 of Vol. xxiii. of the Society's JOURNAL.

11. An invitation has been received and accepted for sending a deputation to visit a Show of Daffodils and other early Spring Flowers and Produce, to be held at Birmingham on April 24 and 25, 1901.

12. The JOURNAL of the Society has been continued, so as to enable Fellows at a distance to enter more fully into and reap the benefits of the study and work of those actively engaged at headquarters. Vol. xxiii., Part 3, Vol. xxiv., containing a full report of the Hybrid Conference, and Vol. xxv., Parts 1 and 2, were issued during the year; Vol. xxv., Part 3, will be ready in March or as soon after as possible.

13. An Examination in the Principles and Practice of Horticulture was held on April 25, concurrently in different parts of the United Kingdom, a centre being established wherever a magistrate, clergyman, schoolmaster, or other responsible persons accustomed to examinations would consent to act on the Society's behalf, in accordance with the rules laid down for its conduct. No limit as to the age, position, or previous training of the candidates was imposed. 286 candidates presented themselves for examination. The names and addresses of those who succeeded in satisfying the examiners, together with the number of marks assigned to each, will be found in the Society's JOURNAL, Vol. xxiii., p. 299.

14. It is proposed to hold a similar Examination in 1901, on Wednesday, April 24. Candidates wishing to sit for the Examination should make application during February to the Secretary, R.H.S. Office, 117 Victoria Street, Westminster.

15. Valuable books have been presented to the Society during the past year by the Director of the Royal Gardens at Kew, Dr. Maxwell Masters, F.R.S., Messrs. H. J. Elwes, F.R.S., J. Wright, V.M.H., J. Veitch & Sons, A. P. Haig, H. J. Hooper, Mrs. Holman, and others, to all of whom the best thanks of the Society are due. A full list will be published in March, 1901, in the Society's JOURNAL, Vol. xxv., Part 3. The Council desire to draw the attention of Fellows possessing Horticultural or Botanical books to the admirable method adopted by Mr. Elwes for enriching the Society's Library without at the same time unduly depleting his own. It is fully explained on p. 338 of Vol. xxiii. of the Society's JOURNAL.

16. The thanks of the Society are due to all the Members of the Standing Committees—viz., the Scientific, the Fruit and Vegetable, the Floral, the Orchid, and the Narcissus Committees—for the kind, patient, and often laborious attention which they have severally given to their departments. Many of the members of these Committees have to travel long distances to attend them. The thanks of the Society are especially due to all who are so good as to serve under these conditions.

17. The Society has also to thank all those who have so kindly presented plants or seeds to the Gardens. A list of the donors has been prepared, and will be found in the Society's JOURNAL, Vol. xxiii., p. 340.

18. The Council wish to express, in their own name and in that of the Fellows of the Society, their great indebtedness to all who have contributed, either by the exhibition of plants, fruits, flowers, or vegetables, or by Lectures or Papers, to the success of the Fortnightly Meetings

in the Drill Hall. They are glad to find by the increased and increasing number of visitors that the Society's Fortnightly Meetings are becoming fully appreciated by the Fellows and public in general.

19. The Lectures given at the Society's Meetings during the past year have been, or will shortly be, published in the JOURNAL, and are as follows:—

Jan.	23	"Flowering Trees and Shrubs," by Mr. George Bunyard, V.M.H.
March	15	"Evolution of Garden Plants," by Mr. R. Irwin Lynch.
April	24	"Cultivation of the Narcissus," by the Rev. S. Eugene Bourne, M.A.
May	8	"Heredity in Plant Life," by Mr. W. Bateson, F.R.S.
June	19	"Aquatic Plants," by Professor Boulger.
July	3	"Garden Roses," by Mr. George Paul, V.M.H.
,,	17	"Lilies," by Mr. R. Wallace.
,,	31	"Cherries and Plums in Pots," by Mr. H. Somers Rivers.
Aug.	14	"Melons," by Mr. A. Pettigrew.
,,	28	"Montbretias and Crocosmias," by Monsieur Emile Lemoine.
Sept.	25	"Saving and Using Rain," by Mr. Peter Kay.
Oct.	9	"Figs in Pots," by Mr. James Hudson, V.M.H.
,,	23	"Mistakes in Orchards," by Mr. John Ettle.
Nov.	6	"The Black Currant Mite," by Mr. R. Newstead, F.E.S.
,,	20	"Mistakes in Fruit Growing," by Mr. George Bunyard, V.M.H.
Dec.	4	"Heating and Ventilating Glasshouses," by Mr. A. Donald Mackenzie.

Besides these Lectures, the Rev. Professor Henslow, V.M.H., has given several Floral Demonstrations, as well as Lectures to the Students at Chiswick, short accounts of which have appeared in the JOURNAL. The best thanks of the Society are due to the Professor.

20. The selection of a suitable site for the new Gardens of the Society in celebration of its Centenary is still occupying the attention of the Society.

21. Several Fellows having represented the difficulty they find in identifying the attendants in charge of the different exhibits at the Society's Meetings, the Council have caused a badge to be prepared which may be worn by attendants, but will carry no special right of admission or other privilege. These badges can be obtained at a small cost by applying at the Society's Offices, and will bear the Exhibitor's name. No other badges will be allowed to be worn by attendants.

22. The Council have the sad duty of recording the death of seventy-nine Fellows during the year, and among them they regret to find the names of His Grace the Duke of Wellington, the Earl of Harrowby, Sir William Cunliffe Brooks, Admiral Sir Henry Fairfax, K.C.B., General Pitt Rivers, F.R.S., Edward Pynaert, R. D. Blackmore, Wellwood H. Maxwell, R. Milne Redhead, John Laing, V.M.H., John Fraser, V.M.H., E. J. Lowe, F.R.S., W. Vanner, W. A. Gillett, A. De la Devansaye, Mrs. Abbott, Miss Mary J. King, and others.

23. It is with feelings of the utmost sorrow that the Council record the loss during the past year of two of their own colleagues—Mr. T. B. Haywood and Mr. Philip Crowley—Mr. Haywood had for many years devoted his business knowledge and capacity ungrudgingly to the service of the Society, and by his personal qualities had endeared himself to all his colleagues. It is difficult to give adequate expression to the more recent loss caused by the death of Mr. Philip Crowley, who has so long and so ably filled the offices of Treasurer of the Society and Chairman of the Fruit Committee. A slight acknowledgment of his services to the Society was made during his lifetime in the JOURNAL, Vol. xxv., p. 158, but his death is still so recent that words fail to convey the depth and reality of the Council's sense of the greatness of the loss they have sustained.

24. In accordance with Bye-laws 61, 62, and 69 the Council duly appointed the Right Hon. the Earl of Ilchester to the seat on the Council vacant by the resignation of Mr. Arthur Sutton, V.M.H., and Mr. George Bunyard, V.M.H., to the vacancy caused by the death of Mr. Haywood. They also appointed Mr. Gurney Fowler to be Treasurer in the room of Mr. Philip Crowley until the Annual Meeting.

25. The following Table will show the Society's progress in regard to numerical strength during the past year:—

DEATHS IN 1900.

		£	s.	d.
Life Fellows	14	0	0	0
4 Guineas	0	0	0	0
2 „	28	58	16	0
1 „	37	38	17	0
	79	£97	13	0

RESIGNATIONS.

		£	s.	d.
4 Guineas	0	0	0	0
2 „	23	48	6	0
1 „	124	130	4	0
	147	£178	10	0
Total Loss	226	£276	3	0

FELLOWS ELECTED, 1900.

		£	s.	d.
4 Guineas	11	46	4	0
2 „	138	289	16	0
1 „	497	521	17	0
Associates	10	5	5	0
Affiliated Societies	8	10	10	0
Commutations = £197. 8s.	9			
	673	£873	12	0
Deduct Loss		276	3	0
Net Increase in Income		£597	9	0

New Fellows, &c.	673
Deduct Resignations and Deaths	226
Numerical Increase	447

The total number of Fellows, Members, Associates, and Affiliated Societies is now exactly 4,750.

26. A scheme for the Affiliation of Local Horticultural Societies was put forward a year or two since, and 120 Local Societies have availed themselves of it. The Council express the hope that Fellows will promote the affiliation of Local Horticultural or Cottage Garden Societies in their own immediate neighbourhood.

27. The Council have decided to hold a Conference on and Exhibition of Lilies, at Chiswick, in connection with one of the ordinary Fortnightly Meetings, at which special exhibits of Lilies will be invited. The conference will take place on July 16, but the exhibition of flowers, &c.,

will be continued on the 17th, the owners of rare or valuable plants having the option of removing them at the close of the first day.

28. At the request of some of the Fellows, the Council have arranged to send (in the week preceding it) a reminder of every Show to any Fellow who will send to the R.H.S. Office, 117 Victoria Street, Westminster, twenty-four halfpenny postcards, *fully addressed* to himself, or to whomsoever he wishes the reminder sent.

29. The Council recommend that the salaries of the principal Officers of the Society—the Secretary, the Superintendent, the Cashier, and the Assistant-Superintendent—should continue as heretofore.

30. The Programme for the ensuing year will be found in the "Arrangements for the Year 1901," lately issued to all Fellows.

31. Subjoined is the usual Revenue and Expenditure Account, with the Balance Sheet for the year ending December 31, 1900.

ROYAL HORTICUL

Dr. **ANNUAL REVENUE AND EXPENDITURE**

	£ s. d.	£ s. d.
To ESTABLISHMENT EXPENSES—		
Salaries and Wages	676 2 0	
Rent of Office	203 3 0	
Printing and Stationery	514 18 8	
Journal—Printing and Postage	1,238 6 2	
Postages	154 5 6	
Coal and Gas	5 3 5	
Donation to Primula and Auricula Society ...	10 0 0	
Miscellaneous	156 7 2	
Commission on Advertisements, *Journal*, &c.	42 11 6	
Painting Orchids Certificated	50 14 6	
		3,051 11 11
„ LINDLEY LIBRARY		3 4 0
„ SHOWS and MEETINGS—		
Rent of Drill Hall and Cleaning	130 4 6	
Temple Show	694 15 3	
Crystal Palace Fruit Show	321 11 2	
Labour	109 3 7	
Expenses of Floral Meetings and Conferences	59 16 10	
		1,315 11 4
„ PRIZES and MEDALS—		
Rose Show	65 0 0	
Committee Awards, &c....	300 12 5	
		365 12 5
„ CHISWICK GARDENS—		
Rent, Rates, Taxes, and Insurance	249 0 1	
Superintendent's Salary	200 0 0	
Pension, late Superintendent	180 0 0	
Labour	676 5 0	
Implements, Manure, Soil, Packing, &c. ...	117 17 5	
Coal and Coke	265 5 6	
Repairs	38 11 9	
Water and Gas	18 19 3	
Miscellaneous	71 14 4	
		1,817 13 4
		6,553 13 0
„ BALANCE TO GENERAL REVENUE ACCOUNT		1,639 14 9
		£8,193 7 9

TURAL SOCIETY.

ACCOUNT for YEAR ending DECEMBER 31, 1900. **Cr.**

	£ s. d.	£ s. d.
By ANNUAL SUBSCRIPTIONS		5,322 6 7
„ SHOWS AND MEETINGS—		
Temple Show	1,242 6 9	
Crystal Palace Fruit Show	264 17 0	
Drill Hall Meetings	40 17 0	
		1,548 0 9
„ ADVERTISEMENTS IN *JOURNAL*	414 1 1	
„ SALE OF *JOURNALS*	62 14 2	
„ MISCELLANEOUS RECEIPTS	39 9 0	
		516 4 3
„ DIVIDENDS—		
Davis Bequest and Parry's Legacy	56 18 4	
Consols, £1,750	45 2 10	
Local Loans, £3,700	105 18 3	
Rupee Paper, 37,000 Rupees	82 9 7	
		290 9 0
„ INTEREST ON DEPOSIT		20 1 1
„ PAINTING ORCHIDS CERTIFICATED		103 2 6
„ PRIZES and MEDALS		55 13 9
„ CHISWICK GARDENS—		
Produce sold	238 16 10	
Students' Fees	31 10 0	
Admissions	3 18 6	
Inspection of Gardens	28 19 0	
Miscellaneous Receipts	34 5 6	
		337 9 10
		£8,193 7 9

HARPER BROS., *Chartered Accountants,*
10 Trinity Square, E.C.

ROYAL HORTICULTURAL SOCIETY.

BALANCE SHEET, DECEMBER 31, 1900.

	£	s.	d.	£	s.	d.
To SUNDRY CREDITORS				29	6	9
" SUBSCRIPTIONS, 1901, paid in Advance ...	140	3	6			
" ADVERTISEMENTS, 1901, paid in Advance	1	16	9			
				142	0	3
" LIFE COMPOSITIONS, Dec. 31, 1899 ...	998	2	0			
Do. do. do. 1900 ...	197	8	0			
				1,195	10	0
" GENERAL REVENUE ACCOUNT—						
Balance, January 1, 1900	7,601	4	11			
Less Bad Debts	3	14	0			
	£7,597	10	11			
" Balance for the Year 1900, as per Revenue and Expenditure Account	1,639	14	9			
				9,237	5	8
				£10,604	2	8

	£	s.	d.	£	s.	d.
By SUNDRY DEBTORS—						
Annual Subscriptions outstanding, estimated at	5	5	0			
Garden Produce	24	17	9			
Advertisements	102	15	6			
Rates and Taxes (Chiswick) paid in advance	28	3	6			
Interest on Investments	65	19	10			
				227	1	7
" CHISWICK SCHOLARSHIPS—						
Amount Expended	39	11	8			
" Received	31	5	0			
				8	6	8
" INVESTMENTS—						
2¾ % Consols £2,122. 8*s.* 9*d.*... ... *cost*	1,892	11	3			
(£2,022. 8*s.* 9*d.* of this sum is held by the Society subject to the provisions of the will of the late J. Davis, Esq.)						
2¾ % Consols £1,750 ... ... *cost*	1,768	5	0			
3 % Local Loans £3,700 ... ... "	3,925	3	0			
37,000 Rupees, Indian Rupee Paper... "	2,462	14	4			
				10,048	13	7
" CASH AT LONDON AND COUNTY BANK—						
On Current Account	316	17	3			
Petty Cash (Head Office)	2	7	7			
" (Chiswick)	0	16	0			
				320	0	10
				£10,604	2	8

We have audited the books from which the above Accounts are compiled, and certify that they exhibit a true and correct statement of the position of the Society on December 31, 1900.

HARPER BROS., ***Chartered Accountants,***
10 Trinity Square, E.C.

GENERAL MEETING

FEBRUARY 26, 1901.

Mr. HARRY J. VEITCH, F.L.S., in the Chair.

Fellows elected (58).—W. C. Alexander, Countess of Ancaster, Mrs. C. Boardman, Lady Bramston, G. A. Bunting, Mrs. Francis Butcher, John B. Caldecot, Benjamin E. Cant, Thomas Challis, F. J. Chittenden, John J. Cooper, J. T. Dolby, Mrs. Gabriel, Capt. H. S. Goodyear, William Goulton, Miss P. Gribble, G. E. Halling, Lady George Hamilton, Edward S. Handcock, Mrs. Harvey (of Carnousie), Arthur G. Hemming, Miss Celia Hemming, Arthur F. Jack, Mrs. Jervis-White-Jervis, Alfred Johnson, Francis D. Lambert, John H. Leslie, William Lomax, J. McCarthy, Mrs. J. McCarthy, Charles D. McKay, Rev. Wyndham Madden, M.A., Mrs. Majendie, Miss M. Nash, A. C. Pass, Mrs. A. L. Payne, Thomas Pendered, John D. Powell, Mrs. Puckle, Sir Thomas Richardson, Miss Muriel E. Routh, Alfred Rowland, Miss Smith, Mrs. Beckwith Smith, Edwin J. Spencer, Mrs. E. Spooner, Dean Swift, Alfred A. Thomas, Charles J. Thompson, Mrs. S. Thompson, Percy W. Tulloch, Theodore Turner, Mrs. J. E. Vincent, Miss Williams, Mrs. Leslie Williams, P. Williams, Miss Maud Williamson, Thomas Ray Willis.

Societies affiliated (2).—Wargrave and District Gardeners' Mutual Improvement Association, Weybridge Gardeners' Mutual Improvement Society.

A lecture on "The Making and Unmaking of Flowers" was given by the Rev. Prof. Geo. Henslow, M.A., V.M.H. (See p. 115.)

GENERAL MEETING.

MARCH 12, 1901.

Mr. JOHN T. BENNETT-POË, F.R.H.S., in the Chair.

Fellows elected (32).—Mrs. H. N. Abbot, Major C. J. Baines, Mrs. J. M. Barrie, Mrs. W. P. Beale, S. G. Brunt, Surgeon-Major W. S. Caldwell, Robt. J. Foster, George Gingell, R. M. Greaves, John D. Hall (Buenos Ayres), John H. Hartill, Mrs. E. C. Healey, Sidney Herbert, F. A. Hinton, Lady Hylton, Mrs. Innis, Richard P. Jones, John W. Laidlaw, Hon. H. A. Lawrence, N. McCorquodale, M. McIntyre, W. J. Maitland, C.I.E., Mrs. C. Mortimer, Dr. G. L. Pearse, Sir W. H. Preece, K.C.B., F.R.S., John Robson, C. H. Sankey, Edward L. Sewell, Mrs. Slingsby, Duchess of Somerset, William Trotter, Lewis Twigge.

In the absence through illness of Mr. G. Davison, who should have spoken of "Climbers for Pergolas, Verandahs, &c.," the Rev. Prof. Geo. Henslow, M.A., V.M.H., kindly gave a lecture on some of the plants exhibited.

At a meeting of the Council held this day the following letter was read :—

Home Office, Whitehall,
8th March, 1901.

SIR,

I am commanded by the King to convey to you hereby His Majesty's thanks for the Loyal and Dutiful Resolution of the Council of

the Royal Horticultural Society, expressing sympathy on the occasion of the lamented death of Her late Majesty Queen Victoria, and congratulation on His Majesty's Accession to the Throne.

I am, Sir,
Your obedient Servant,
CHAS. T. RITCHIE.

Sir Trevor Lawrence, Bart.,
57 Prince's Gate, S.W.

GENERAL MEETING.

MARCH 26, 1901.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

Fellows elected (42).—Charles L. Adams, Robt. Anderson, Mrs. Baillie, Chas. E. Baker, Joseph Bentley, C. J. Billson, M.A., Mrs. Birch, Mrs. F. Braund, Lady R. Christie, Mrs. J. Christy, Mrs. Corbet, A. Depledge, A. Dewsbury, R. Durham, Mrs. E. M. Elliott, Mrs. Engleheart, General Sir R. Gipps, K.C.B., Lady Gipps, Ernest E. Grimson, W. R. Hawkins, Mrs. H. Heath, James Joicey, R. P. Kitson, Mrs. Gore Langton, Miss Mansel, F. W. Metcalfe, W. H. Meyers, M.P., John Newmarch, Walter Price, A. E. Prothero, Walter Ridley, Lewis H. Samuel, Mrs. Schuster, Mrs. A. K. Shephard, Miss E. Sieveking, M. H. Sinclair, J. Stevenson, Rev. H. Swann, George Todd, Miss Vigor, H. J. Wigram, Miss Wilson.

Society affiliated (1).—Coniston Horticultural Society.

A paper on "Inconspicuous and Rarely Cultivated Orchids," by Mr. W. H. White, was read by the President. (See p. 136.)

GENERAL MEETING.

APRIL 9, 1901.

The Rev. W. WILKS, M.A., in the Chair.

Fellows elected (40).—Lady Anstruther, Mrs. Stanley Bartrum, Mrs. Bernard Brodhurst, Samuel Gurney Buxton, J.P., J. J. Chapman, Arthur Charles Cork, George Crispin, William C. Dickey, Samuel B. Dicks, J. E. Downing, F. Martin Duncan, Miss Mary Froude, William A. Garraway, Mrs. Hugh Goodacre, Major-General Sir Francis Grenfell, K.C.M.G., Miss Ada Harrison, C. Johnston Hill, Lady Hunter, Mrs. Langford, Harry V. Letts, T. P. Ling, Mrs. F. Mansel-Jones, E. C. Marshall, Geo. Massey, G. C. Maynard, Mrs. L. Micklem, Miss Mary Mole, Samuel P. Jackson, Joseph A. Pledger, H. L. Powys-Keck, G. R. Quilter, George Schneider, William Seward, Colonel Spragge, D.S.O., Miss Stobart, Mrs. J. J. Harris Teall, William R. Turner, Alfred Warner, Mrs. J. Warrack, James Willing.

Associate (1).—Miss Eleanor Morland.

A lecture on some of the plants exhibited was given by the Rev. Professor George Henslow, M.A., V.M.H. (See page 158.)

GENERAL MEETING.

APRIL 23, 1901.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

The Secretary read the notice calling the meeting.

The following notice has already appeared in the *Times* of April 12, and in the *Gardeners' Chronicle* of April 13, in conformity with the Society's Bye-laws, Nos. 32 and 34 :—

> ROYAL HORTICULTURAL SOCIETY.—Notice is hereby given that a General Meeting of the Fellows of the Society will be held at the Drill Hall of the London Scottish Volunteers, Buckingham Gate, Westminster, on Tuesday, April 23, at 3 p.m., to consider, and if approved to adopt, the proposal of the Council to purchase on behalf of the Society for the purpose of its new Gardens forty-eight acres of land in the County of Kent, forming part of Rabbits Farm, and adjoining the Little Boys' Home at South Darenth.
>
> By order of Council,
>
> W. WILKS, *Secretary.*

The Minutes of April 9 were read and signed.

Fellows elected (50).—The Duchess of Abercorn, Lord Alverstone, C. Spearman Armstrong, John Atherton, Mrs. Barnett, Charles E. de Bertodano, Miss Mary de Bertodano, Arthur J. Brown, Mrs. Spencer C. Charrington, J. Coppin, George Cursons, Edmund W. Davis, John Harrison Dick, Henry Druery, Mrs. Broughton Dugdale, Miss Gasquet, John Harris, Mrs. Thomas Holton, Alfred James, Mrs. Johnston, Edward Thomas Lightfoot, E. B. Lindsell, Mrs. Lloyd, George Mackinlay, Augustus Meyers, Mlle. de Montgeon, Mark Moody, Claude H. Paine, Ernest Pearman, Amos Perry, jun., Mrs. Radford, Frank P. Richardson, Bishop of Richmond, Mrs. Sandford, S. Schultz, W. T. Sich, Sidney Simpson, Alfred H. Sly, Mrs. Willoughby Smith, Right Hon. Arthur H. Smith-Barry, Lady Henry Tate, Lady Helen Vincent, C. Wakely, Walter J. Walter, Walter G. Watson, Mrs. E. Weston, Ernest C. White, Mrs. G. W. Willock, John Winter, Mrs. John Winter, H. Young.

Associates (2).—W. Daniels, W. H. Gostling.

The President, having explained the object of the meeting, called upon Mr. H. J. Veitch, F.L.S., who moved the following Resolution :—

> "That the Council be empowered to purchase, on behalf of the Society, for the purpose of its new Gardens, forty-eight acres of land in the County of Kent, forming part of Rabbits Farm, and adjoining the Little Boys' Home at South Darenth."

This having been seconded by Mr. Charles E. Shea, F.R.H.S., Mr. Arthur Sutton, V.M.H., moved the following amendment :—

> "While thanking the Council for the trouble they have taken in seeking a site for a new Garden, this meeting is of opinion that the proposed site is not the best means of celebrating the forthcoming centenary of the Society."

This, having been seconded by Dr. Masters, F.R.S., and discussed, was declared, on a show of hands, to be carried.

The President announced that the Council did not propose to take a poll on the matter.

A vote of thanks to the President concluded the meeting.

GENERAL MEETING.

MAY 7, 1901.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

Fellows elected (69).—Mrs. Adair, George Allen, Rev. H. H. Allott, Mrs. Bailie, Dr. Frank R. Blaxall, Charles T. Boosey, H. B. Brown, A. J. A. Bruce, A. M. Butler, Lady Cadogan, Mrs. Cecil Chapman, Mrs. B. L. Cohen, Gordon Coombe, H. N. Corry, John Cowan, John C. Cowan, Henry G. Cox, Charles Crapper, Mrs. Danvers, Henry J. Drewitt, Sydney E. Dunn, Edgar Figgess, Mrs. E. Fletcher, Miss F. Fowke, Mrs. Fuller, Lady Payne Gallwey, Percy Geach, John Gould, Albert Gray, Mrs. Albert Gray, Miss P. A. Hanbury, John F. Hindley, Evan Hodgson, Mrs. Holden, Frederick G. Ivey, Mrs. Jarvis, William Kenny, Thomas Kingscote, Miss Clara Mangles, Alexander Maxwell, Walter Mayriss, Arthur Micklem, Mrs. Milner, Miss Ethel Montgomery, Edward Parry, Mrs. Jos. A. Pease, William C. Penfold, Arthur R. Poole, Lord Powis, Miss Priestley, Thomas Rose, Mrs. E. Rutter, A. Gerard Salvin, Walter W. Sheath, A. C. Shepherd, W. Lepard Smith, Mrs. Stone, John Stubley, Horace R. Taviner, Percy Taviner, Edward Tufnail, Joseph G. Turner, G. E. Wainwright, Miss Diana G. Walker, Mrs. H. Waring, J. R. Warren. Mrs. Wissmann, A. J. Wood, S. Colvin Wood.

Associates (2).—F. H. Goddard, Miss Maxwell.

The President, Sir Trevor Lawrence, Bart., V.M.H., said that it would be within the memory of most of the Fellows that, with the assent of Her Most Gracious Majesty the late Queen Victoria, the Society in 1897 instituted the Victoria Medal of Honour in Horticulture, and in order to commemorate the sixty years of her reign the honour was limited to sixty recipients living at one time. The Council had since the lamented death of Her Majesty determined to increase the number to sixty-three, and to limit it strictly to that number for all time to come, so as to recall to all future garden lovers the sixty-three years of Queen Victoria's glorious reign.

Sir Trevor announced that as a result of the increase from sixty to sixty-three, and in consequence of the recent death of one of the Medallists, the Council had had four Medals of Honour to allot, and it now became his very pleasant duty to hand them to their distinguished recipients, Miss Eleanor A. Ormerod, LL.D., Sir George King, K.C.I.E., M.B., LL.D., F.R.S., Mr. George Norman, F.R.H.S., and Mr. James Sweet, F.R.H.S. He added:—

Miss Ormerod (fig. 116) was known all the world over for her most patient and painstaking investigations into the life-habits of all insects,

friends or foes, affecting agricultural or horticultural products. It was impossible to cite one example of her work more than another, for she had "observed" and traced the life-history of *all* such insects, from the smallest to the greatest, from the Currant-bud mite to the goat caterpillar and the stag beetle, and has informed horticulturists what to cherish as friends of gardening and what to destroy, and how best to do it.

Sir George King (fig. 117) was appointed Curator of the Botanic Garden, Calcutta, in 1871, which he thoroughly reorganised and im-

FIG. 116.—MISS ORMEROD, LL.D., V.M.H., &c. (*Journal of Horticulture.*)

proved. He also revolutionised the Chinchona plantations of Darjeeling, and combated the disease so successfully that the quinine, which used to cost the Government 15*s.* an ounce, now only costs 1*s.* 4*d.* He has published a series of invaluable illustrated 4tos of the "Natural Orders of India," and has written monographs on Figs, Magnolias, Nutmegs, Oaks, Breadfruits, and Custard Apples. Gardeners are also indebted to him for his great work on the Sikkim Orchids, and he is now engaged on a *magnum opus* on the Flora of the Malay Peninsula.

Mr. George Norman (fig. 118) was well known as a thorough English gardener—good in all branches of gardening, excelling most, perhaps, in

FIG. 117.—SIR GEORGE KING, K.C.I.E., M.B., L.D., F.R.S., V.M.H. (*Gardeners' Chronicle.*)

fruit and vegetable cultivation, and herein especially with forced Strawberries. For many years he has been an active and useful member of

FIG. 118.—MR. GEORGE NORMAN, V.M.H. (*Gardeners' Chronicle.*)

the Society's Fruit Committee. He has been gardener to the Marquis of Salisbury at Hatfield since 1876.

Mr. James Sweet (fig. 119) had been one of the pioneers of the existing race of *large* London market gardeners. He is said to have been the first to build extensive glass houses for the growth of 'Alicante' and

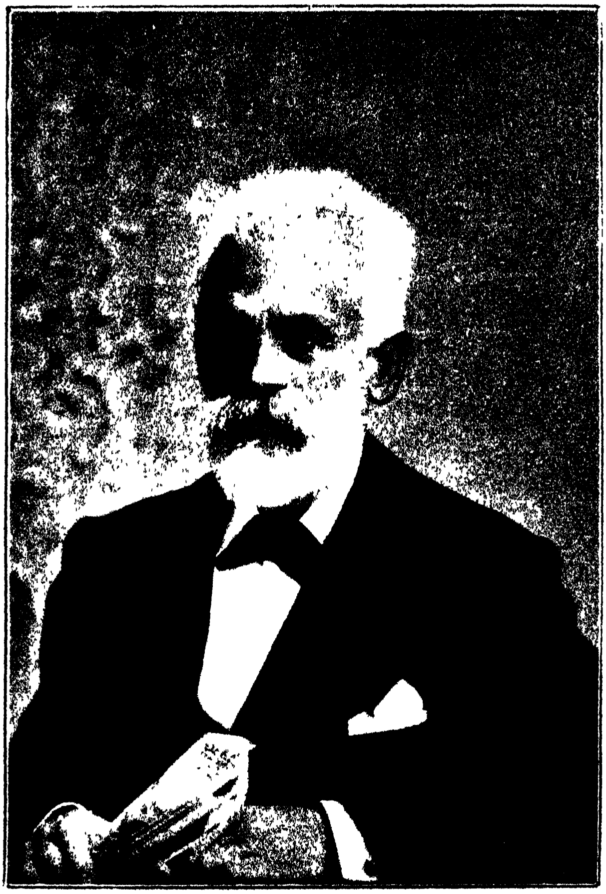
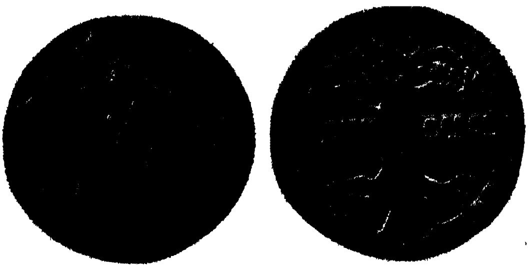


FIG. 119.—MR. JAMES SWEET, V.M.H. (*Journal of Horticulture.*)

'Gros Colmar' Grapes for London, and has trained more young men in market gardening than anyone living, and that most successfully Mr. Thomas Rochford and Mr. Peter Kay may be mentioned amongst them. He was also the originator of the "Hailstorm Corporation" for insuring glass houses.



DEPUTATION TO BIRMINGHAM.

APRIL 25, 1901.

A small Deputation was appointed by the Council, at the invitation of the Executive of the Midland Daffodil Society, to visit their Exhibition of Spring Flowers at Birmingham.

The Deputation consisted of—

F. W. Burbidge, Esq., M.A., V.M.H.
John T. Bennett-Poë, Esq., Member of Council.
The Hon. John Boscawen, Member of the Narcissus Committee.
The Rev. George Engleheart, M.A., V.M.H.
Alfred H. Pearson, Esq., Member of Council.
The Rev. W. Wilks, M.A., Secretary R.H.S.

The Deputation arrived at Birmingham on Wednesday, April 24, and were received at the railway station by the officers of the Society, who kindly conducted them to several points of interest in the city, after which they were most hospitably entertained at dinner by Robert Sydenham, Esq., Hon. Treasurer of the Society.

On Thursday, 25th, the Deputation drove to the Show ground—the beautiful Botanic Gardens at Edgbaston, where they could not help envying the horticultural advantages possessed by the citizens of the great Midland metropolis.

After the Deputation had made their awards they were (together with the judges of the Show) entertained at luncheon, at 1 P.M., at which the Lord Mayor of Birmingham presided.

The Deputation brought away with them from Birmingham, not only the recollection of the beautiful spring flowers of the Midlands, but also the remembrance of the most kind and lavish hospitality extended to them by all.

AWARDS AT BIRMINGHAM.

Silver-gilt Flora Medal.

To Messrs. Barr, of King Street, Covent Garden, for a group of Daffodils.

Silver-gilt Banksian Medal.

To Messrs. Pearson, of Lowdham, Nottingham, for a group of Daffodils.

Silver Flora Medal.

To Messrs. Wallace, of Colchester, for a group of Spring Flowers.

Silver Banksian Medal.

To Miss Currey, The Warren, Lismore, Ireland, for a group of Daffodils.

To Mr. Robert Sydenham, of Birmingham, for a group of Tulips.

To Messrs. White, of Spalding, for a group of Daffodils.

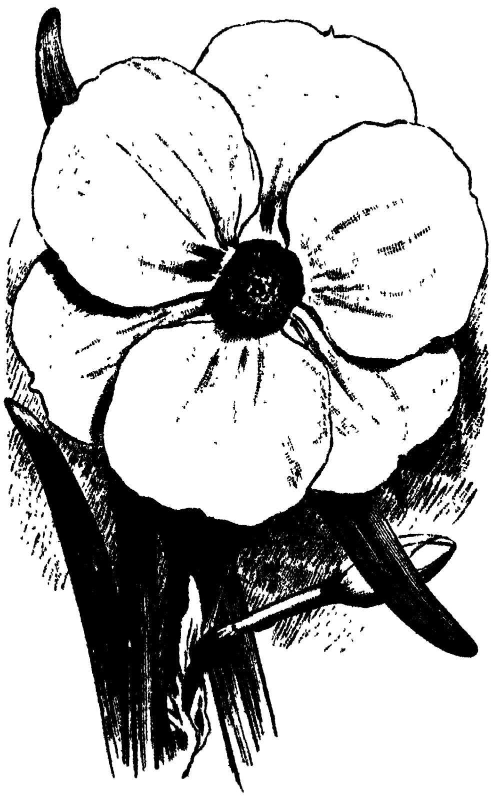
To Messrs. Gunn, of Brookfield, Olton, for a group of Daffodils.

First-class Certificate.

To Daffodil 'Sunrise' (votes, unanimous), from Mr. R. O. Backhouse, Sutton Court, Hereford. A very beautiful flower with a white perianth and large brilliant orange-scarlet cup.

Award of Merit.

To Daffodil 'Sunbeam' (votes, unanimous), from Mr. Backhouse. Perianth pale, almost creamy-yellow, with a very brilliant orange-scarlet cup.



SCIENTIFIC COMMITTEE.

JANUARY 15, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and seven members present.

Loss of Reserve Matter in Pruning.—The following communication on pruning Vines was received from Mr. Thomas Sharpe, Westbury, Wilts :—
"The method in vogue of managing the growth and subsequent pruning of Vines appears to result in considerable loss of reserve matter. Physiology teaches that the compounds elaborated in the leaves, after necessary supplies are made to current growth and fruit, are stored for future use. Some of these are stored for the use of the buds on the shoot the following spring. No. 1, the lowest or basal bud, is required for the fruiting lateral next season; but No. 2, the next, and onwards, are not, and are therefore cut off at pruning-time, resulting in the loss of all the reserve matter stored in the shoot above No. 1. If I understand aright, every living cell of a plant is a perfect entity, though the connecting strands of protoplasm may manifest a quasi-symbiosis, the supreme object of which is perpetuation either sexually or vegetatively as environment may render exigent. A mole, a rat, a rabbit, or even a toad may burrow under a Strawberry plant in summer, destroying more or less of the roots. The plant, deprived of a full supply of sustenance, becomes a suitable host for red-spider, which makes its wonted havoc. The plant in consequence makes but miserable growth in August and September. The flowers of this plant next season will be small, but the pollen abundant, the growth of the tori stunted, but it may bear a mass of seeds. Again, a healthy Blenheim Apple tree attracts attention, the owner having arranged a manure heap in such a position that the liquid from it will keep the tree oversupplied. Result: More growth the first season, but a diminishing growth afterwards for a few years, then two heavy crops of wretched fruit, all core and seeds. In these two instances of untoward environment the plants have adapted themselves by concentrating all their stamina to seed production. Can we turn such adaptations to account by the prevention of preparation for vegetative perpetuation above No. 1 bud in the Vine's growth? Acting upon these thoughts, I disbudded my laterals above No. 1 last July. Apart from really satisfactory appearance, the Hamburgs exhibited no striking developments near the spurs, but the Muscats show protuberances at the bases of the spurs, and these are quite conspicuous on that part of the rod which is four years old."

Mr. Hudson observed that it is always the basal bud which is used for stock purposes, as the eyes or buds decrease in strength from below upwards along the lateral shoots. The basal bud always gives the most compact bunches of Grapes, the others supplying looser ones. He added that no pruning should be done until all the leaves had fallen. If the reserve material be contained in the shoot above the basal bud, and it be suggested by Mr. Sharpe that this could be utilised, then every bud must be suppressed except the basal. Experiments would show, by comparison with those in which the lateral had been pruned down to the basal buds,

whether the Grapes showed any superiority. It is hoped that Mr. Sharpe would continue his experiments, and record comparative results.

Injured Peach-shoots.—Mr. James Hawkes, of Osterley Park, Isleworth, sent shoots with the following remarks: "During the past two seasons, about the time the house is closed for forcing, a great many of the young shoots of Royal George (age of tree twelve years, growing in an early Peach-house, and ripening at the end of June) have black rings round them, and from the buds small globules of gum exude. The tree in question has cropped well, has plenty of fibrous roots, and the growth is not over-strong. It has not been subjected to high or extremes of temperature, and is well supplied with water, nor has it been overfed with manure."

The specimens were sent to Dr. W. G. Smith for examination and report.

Climbing Cactus.—Dr. Masters, F.R.S., exhibited photographs of a spirally climbing Cereus, having a flattened stem, and spines proceeding from the edges. It was a species named *Cereus Wittii*, from Brazil. The photographs were received from Dr. Schumann, of Berlin. Mr. F. Im Thurn observed how Cereus in Guiana at first grows flat against a support, but when it grows freely above assumes a more cylindrical character. It would seem, therefore, to be one of Kerner's so-called "leaning" climbers, which often form a lattice-work by intersection of their shoots, if they have no adhesive roots such as some species of Cereus possess. Professor Henslow, V.M.H., observed that the change of form is probably correlated with a different distribution of the mechanical or supporting tissue, for he finds that an Ivy-shoot when supported has more pith and less wood than one of the same diameter but growing freely in the air, in which the proportions of wood and pith are reversed. Dr. Schumann writes thus of it to the *Gardeners' Chronicle*:—

Cereus Wittii (*K. Sch.*).—Among the numerous novelties which the last decade of the past century brought to Europe this Cereus is surely one of the most interesting for both the amateur and the professional cultivator. I received this curious plant through the kindness of Mr. N. H. Witt, of Manaos, Erlado do Amazonas, Brazil. He told me, long before he was able to send specimens, that a climbing species of a genus he was not able to determine grew in the swampy forest of Igape, on the Amazon River. Closely appressed to the stems of the trees, and fixed to them by numerous roots, in the region of the yearly inundation, there creeps a Cactus with the habit of a Phyllocactus, but armed with very sharp spines. It is so closely connected with the plant on which it grows that one must look carefully to distinguish it. In fig. 120 the Cactus is represented creeping over a Palm-stem which is provided with great thorns, that prevent the Cactus from being removed from the bark. The joints have been therefore bent and broken, to avoid the thorns, and that enables the Cactus to be more readily recognised.

When I had the specimen in my hand, after it was unpacked, I did not at all know how to class it. I was not able even to indicate the genus. It could not belong to Phyllocactus, however much the form of the leaf-like joints suggested that genus. Perhaps it might be a very abnormal species of Rhipsalis, but the flowers or fruits being absent, the question could not be answered.

Last autumn I was fortunate enough to get, by the aid of Mr. N. H. Witt, plentiful specimens of the plant. After having carefully

FIG. 120.—CEREUS WITTII, A CLIMBING CACTUS. (*Gardeners' Chronicle.*)

The right-hand branch shows the Cactus appressed to the stem of a Palm; the joints have been represented as more conspicuous than they really were in the photograph. The left-hand branch has been broken at intervals to detach the joints of the Cactus and render them visible.

examined it, I found two fruits of ovoid form as large as a pigeon's egg, beset with very sharp prickles. This organ had all the characteristics of

the genus Cereus, and I could now name the species, and did so in honour of the finder, *Cereus Wittii.* The species is very interesting, because it is the "missing link" between the genera Phyllocactus and Cereus. The form of the joints is perfectly typical of the former; the characteristics of the fruits and spines are those of a Cereus.

Some days ago I received a notice from Dr. E. Ule, a botanist, whom I had sent from Manaos to the river Furná, a tributary stream on the right side of the Amazon—that he had found a peculiar Cactus in the upper part of the swampy forest, densely appressed to the tree-stems. His further description of the plant convinces me that *C. Wittii* is widely distributed. He told me that the older joints of *C. Wittii* turn from green to a beautiful wine-red or purple colour, a peculiarity which I had also seen on the plants we are cultivating in the Royal Botanic Garden of Berlin.

The two photographs were taken by our skilful Orchid grower, Herr Benick, who cultivated these two splendid specimens. In the "Monatsschrift für Kakteenkunde" Dr. Schumann gives a fuller account of this new species (vol. x. p. 153), accompanied by an excellent plate, in which not only the habit of the plant but the fruit and seed are well illustrated. The armature of sharp spines along the edges of the flattened, adhering stems probably do not come out very clearly in fig. 120, but they are very characteristic in the figures published in the above-named organ of the German Cactus Society.

Carnations, Single and Double, on one plant.—A drawing was received from Mr. William Cuthbertson illustrating this not uncommon occurrence. Mr. Michael, Mr. Sutton, and Dr. Masters had observed similar cases, as in Begonias also, especially late in the season. An analogous occurrence is seen in *Clematis Proteus,* which bears double flowers early in the season, but single ones afterwards. In all cases it appears to be due to a check of nutrition.

Pinus Cone.—Dr. Masters, F.R.S., exhibited a fine cone, received from Sir Ch. Strickland, of *Pinus ponderosa var. Benthamiana.* It is a native of California.

Mistleto variety.—Mr. Corderoy, of Didcot, sent a bough of Mistleto bearing longer and broader leaves than those of the usual wild form. It was believed to have been cut from an Apple tree. It was observed that the variety arose from some innate cause, but, of course, traceable to its parasitism, and that as Apples vary by the change of their environment, so the Mistleto is similarly affected.

Australian Rhubarb.—Mr. A. Sutton, V.M.H., called attention to a variety of Rhubarb from Australia, grown at Reading for some few years. It starts into growth every year in November, producing leaves with stalks 2 feet long and three-quarters of an inch in diameter, of a scarlet colour. Unfortunately, in this climate it can only be depended upon during a mild season, the late frosts having destroyed it. As Rhubarb is a native of N.E. Asia, it had apparently quite changed its habit in Australia, where the seasons are reversed; but this variety has for the present retained in this country the period of leafing which it acquired in the S. hemisphere.

Clavaria, Rare.—Mr. Geo. Bunyard, V.M.H., sent a plant found grow-

ing on Pine wood in a cellar. It is snow-white, much branching, with pointed ends. Dr. M. C. Cooke reports that it is the very rare species *C. Krombholzi.*

SCIENTIFIC COMMITTEE, JANUARY 29, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and three members present.

Bryonia dioica Root.—Mr. W. G. Smith sent an enormous root of the common Bryony. He says that the weight, after being kept for two months in a dry room, was just over 21 lbs., and had not the ends of the thick branching roots been broken off, it would have been at least 5 lbs. heavier. The length even in its broken condition was 2 feet; the circumference at the middle 22½ inches. It was dug out of brick-earth at Caddington Hill, near Dunstable. It appears to much exceed the average size, for Dr. R. Hogg writes in his "Vegetable Kingdom":—"The roots are of an immense size, sometimes a foot or 2 feet long, and as thick as a man's arm." It is occasionally offered for sale as the "Mandrake," but the latter is not a British plant. The root abounds in starch, which could be extracted by grating it to a pulp and straining with cold water; but the juice is decidedly poisonous, as are also the berries of the Bryony.

Abies lasiocarpa var. arizonica.—Foliage and bark of this new variety were sent by Herr H. Henkel, from Darmstadt. Though the species ranges from Oregon to New Mexico, this variety only occurs on the mountains of Arizona. The bark is remarkable in being of a creamy colour, and corky in nature. The foliage is bright glaucous green above, but white below, probably due to its mountain habitat. Herr Henkel observes that he has succeeded in importing and establishing this tree, which he names *Abies arizonica* (Merriam) *var. argentea.* The plants were collected at an altitude of from 7,250 to 10,000 feet, the temperature being as low as −25° to −30° (C.), or −13° to −22° (F.). Writing of it in the *Gardeners' Chronicle*, Dr. Masters, F.R.S., says:—The bark is of a thick corky texture and of a creamy-white colour. The linear, oblong, notched leaves are silvery-white on both surfaces; stomata occur also on both faces of the leaves. The resin canals are placed in the centre of the leaf-tissue (parenchymatous). I have not seen the cones, but from the description they must be like those of *Abies lasiocarpa,** Nuttall, to which some years since I referred the *A. subalpina* of Engelmann and the *A. bifolia* of Murray.†

I have not seen Dr. Merriam's original description, but I may cite what is said in the *Botanical Gazette* (Chicago), November, 1896:—"Dr. C. Hart Merriam has described (Proc. Biol. Soc., Washington, 10, 115–118, 1896) a new Abies from Arizona. It is from the San Francisco mountain region, and is remarkable for the colour and character of its bark, being one of the most conspicuous trees on the mountain between

* *Abies lasiocarpa*, Nuttall, *var. arizonica*, Lemmon = *A. arizonica*, Merriam. See *Botanical Gazette* (Chicago), November, 1896; *Gardeners' Chronicle*, January 11, 1897, p. 35; Sargent, *Silva*, xii. p. 113 (1898); *Abies arizonica*, Merriam, *var. argentea*, *Hort. Henkel.*

† *Gardeners' Chronicle*, 1889, p. 172; and *Journal of Botany*, xxvii. 129.

the altitudes of 8,950 and 9,500 feet. It was even found at an altitude of 11,000 feet by Mr. Purpus when collecting in Arizona. The substance of the technical description is as follows:—*Abies arizonica.*—About 15 m. high; bark a highly elastic, fine-grained cork, whitish or greyish (usually creamy-white), with irregularly sinuous greyish ridges; leaves of cone-bearing branches thick, sub-triangular in section, sharp-pointed at the apex, about 2 cm. long; leaves of lower branches much longer, flatter, blunt, and notched at the apex, 2·5 to 3 cm. long; cones dark purple, slender, medium, or rather small; scales much broader than long, strongly convex laterally, purple on both sides; bract (without awn) reaching to or past middle of the scale, its body much broader than long."

Prof. Sargent places little reliance on the presence of corky bark as a diagnostic character, pointing out that it occurs on other trees in the same region, and is therefore probably of climatal origin.

"Corky bark is particularly noticeable on trees on the San Francisco peaks of Arizona, where a similar peculiarity characterises the bark of *Abies concolor* and of *Pseudotsuga mucronata* (*Douglassii*). Upon the strength of the spongy bark of the Arizona trees, and of some peculiarity in the form of their cone-scales, Dr. Merriam established his *Abies arizonica.* I have seen bark equally corky, however, on *Abies lasiocarpa* in Colorado and eastern Oregon, and in southern Alberta and British Columbia, and also the scales of cones produced by trees on the Blue Mountains of Oregon which in shape cannot be distinguished from those which grow on the San Francisco peaks." Sargent, *Silva*, xii. 118.

Be this as it may, it is clear from Mr. Henkel's specimens that the tree is very distinct for cultural purposes. Its whitish, Birch-like, corky bark and silvery foliage, the colour of which, according to Mr. Henkel, surpasses that of *Picea pungens argentea*, render it very attractive. The tree, as has been said, grows on the mountains of Arizona at a height of from 7,250 to 11,000 feet, where it is exposed to great cold, and will therefore presumably be hardy in this country. Mr. Henkel calls it *Abies arizonica var. argentea.*

Australian Rhubarb.—Specimens were sent by Mr. Sutton of this Rhubarb, alluded to at the last meeting. The stems were very slender, about a foot long, and of a bright scarlet colour.

Pinus austriaca attacked by Beetle.—A branch perforated by some beetle was received from a resident of Fordington, Dorchester. It was sent to Mr. McLachlan, F.R.S., for determination.

Croci Species and Varieties.—An interesting series was exhibited by Mr. E. A. Bowles, of Myddelton House, Waltham Cross, together with the following particulars:—

C. biflorus; —v. *argenteus.*—An abnormal bloom with eight perianth segments and five style branches; —v. *estriatus.*—The unstriped form from Florence; —v. *Leichtlini.*—A small-flowered form intermediate between v. *estriatus* and v. *nubigenus*, pale blue, external surface of outer segments yellowish, with broad band of pale blue down the centre; anthers of a curious shade of greenish-grey. This tendency to melanism in anthers of Croci of the section *annulati* of Maw was further illustrated by specimens of *C. Crewei*, in which the anthers are a deep chocolate, and *C. chrysanthus* vars. *fuscotinctus* and *fuscolineatus*, with anthers of a

dark smoke colour and the typical form of *C. chrysanthus*, in which the barbs at base of the anthers are tipped with black.

C. Korolkowi in two vars. *a.* The type as distributed by Dr. Regel and figured by Maw: a small, shy flowering, late form; external surface of outer segments grained with rich brown, throat externally nearly black. *b.* Larger, paler, very floriferous and robust in habit; in bloom three weeks earlier; external graining grey, greenish-blue at throat.

C. ancyrensis.—Type and a specimen externally feathered with brown, a variation not hitherto noticed in this species.

C. Fleischeri, a delicate species, with long, narrow perianth segments, white, the three outer externally lined purple; —v. *albus*, without the external purple markings except at the throat, and, contrary to rule with albino forms, has the appearance of being a more robust form, with wider perianth segments.

C. Balansæ, an abnormal bloom, semi-double, of the form with outer segments externally rich mahogany colour.

C. dalmaticus, the true plant, with large, very pale mauve flowers, outer surface of outer segments pale buff, veined with grey at the base.

C. Tomassinianus, pale and dark varieties.

C. Imperati, several varieties.

All were from the open ground except *C. Fleischeri* and *C. Korolkowi* type, which were grown in a cold frame.

SCIENTIFIC COMMITTEE, FEBRUARY 12, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and twenty members present.

In response to the invitation of the Council of the Royal Horticultural Society to well-known men of science to join the Scientific Committee, with the view of rendering it more useful, a large gathering of new and old members assembled after the Annual Meeting; and a very interesting discussion took place over the numerous exhibits, as well as upon a *vivâ voce* abstract of his paper upon "Hybrid Conifers," by Dr. Masters, F.R.S., which will be found in full at page 97.

Mr. Elwes, F.R.S., observed that it would be of assistance to the Secretary if there were an unwritten rule of the Committee that whoever contributed specimens, whether sent or brought to the meetings, should also supply as full details as possible, for preservation in the reports, which would finally be recorded in the JOURNAL. He also thought that when a valuable series of plants was shown, as on the present occasion by Mr. Lynch, the most important at least should be preserved, as they might not even be in the National Herbaria. With regard to notes, &c., on specimens sent, Professor Henslow observed that as a rule something was usually said about them, but too often of a very meagre description. What, however, would enhance the value of the reports would be for those who had observations to make at the meeting to send him a more complete account than is conveyed by the remarks which occur at the moment, if such should be thought desirable.

Hybrid Conifers.—Dr. Masters, F.R.S., presented a paper on this subject, in which he remarked on the rarity of hybrid Conifers in Nature in

spite of the profusion of pollen that is formed. This rarity he attributed to the fact that, in the Old World at least, the forests consist mainly of one species. Allusion was then made to the various hybrids in the genus Pinus described by Beck, Wettstein, Mayr, and others, and to the so-called hybrid between *Juniperus nana* and *J. communis*, in reference to which Dr. Masters showed specimens of both forms taken from the same bush. *Biota meldensis*, a supposed hybrid, is only a transitory stage of *Thuya orientalis*. The only two artificially produced hybrids known are one raised by M. Croux between *Abies Pinsapo* ♂ and *A. Nordmanniana* ♀, and another raised by the late M. Henri de Vilmorin between *Abies cephalonica* ♂ and *A. Pinsapo* ♀. Specimens of these hybrids, by the courtesy of M. Croux and of M. P. de Vilmorin, were shown. M. de Vilmorin's hybrid Abies had produced cones, two of which were exhibited, together with those of the parent plants. Last year a single fertile seed was obtained, whose progress will be watched with the deepest interest. Details relating to the external features and internal anatomy of these hybrids are given at length in the paper, which will be found on page 97.

Snowdrops Diseased.—Mr. H. Lewis Jones, Wimpole Street, sent some specimens of *Galanthus Elwesii*, with the following note:—"They were planted for three years. A top-dressing of manure was put over them in autumn. There was nothing wrong until this year, when a large number came up healthy, but the later members (about half of 500 in all) came up slowly, were yellowish later, and proved to be diseased. It seems to be spreading in both of my beds of bulbs. They are at the foot of a wall, with an easterly aspect. The soil is light, with a chalky subsoil." Professor Farmer undertook to investigate the nature of the disease, and specimens were also sent to Dr. W. G. Smith.

Cypripedium Malformed.—Mr. O'Brien, V.M.H., exhibited a dimerous flower of *C. insigne*, and a pale yellow-green leaf from the same plant. He remarked that these two features had been constant on one and the same plant for three or four years. Though both peculiarities are not uncommon, it was unusual to find them on the same individual.

Galanthus species.—Mr. Elwes, F.R.S., showed flowers and foliage of *G. Elwesii* and the so-named *G. Whittalli*, pointing out that the latter is only a local variety of the former, with somewhat broader leaves and sepals, there being also a slight difference in the green colouring of the petals. He observed that *G. Elwesii* is a great seeder, and apparently in consequence fails to produce bulbils for propagation; such is also Mr. Barr's experience.

Mistleto, vars.—Mr. Burbidge, M.A., V.M.H., sent several varieties from the Botanical Gardens of Trinity College, Dublin, with the following observations:—"I send five varieties of *Viscum album*, all, as I think you will see, slightly different in habit, size of leaf, &c., as also in earliness or time of flowering. You will observe that in all cases but one the male plants have larger leaves than the females. Another point is peculiar about Viscum and its time of flowering—viz., the males in all cases flower a week or more earlier, or before the females, as is also the case in *Aucuba japonica* and some other diœcious plants. The male Viscum has foliage of a brighter green, while the females have leaves of a deeper and more sombre or sap-green colour. Amongst the female or fruiting plants of

Viscum there is also considerable difference in size, colour, and time of ripening of the berries, as there is also in the time of opening of the male flowers, some individuals being weeks earlier in bloom than are others.

Fig. 121.—Aloe Lynchii ×. (*Gardeners' Chronicle.*)

The male Viscum has often in its young state on young Apple trees, or on the Mountain Ash, enormous leaves; but these become smaller as they begin to flower. The host-plant, soil, aspect, &c., may affect the plants,

but there is also a considerable range of seminal or inherent variation. Note the beautifully regular dichotomous growth of the branches, all the twigs lying in the same plane, and the half twist in the leaf at the base."

Mr. R. Irwin Lynch contributed the following interesting plants and notes from the Botanic Gardens, Cambridge:—

Iris histrioides.—This species is not recorded in Sir M. Foster's book, and is probably of more recent introduction.

Iris stylosa.—A narrow form of this species, Mr. Elwes, F.R.S., observed, was introduced by him in 1874 *I. cretensis*, allied to *I. unguicularis*, exhibited by Mr. Bowles.

Galanthus Erithræ.—Not mentioned by Mr. Baker.

Aloe Lynchii ×.—A very curious hybrid Aloe raised by Mr. Lynch in 1877 between *Gasteria verrucosa* and *Aloe striata.* The flowers and general habit resemble those of an Aloe, whilst the leaves are in many ways like a Gasteria. It is a most interesting plant, combining as it does the characteristics of two such dissimilar parents. (Fig. 121.)

Hyacinthus ciliatus (*azureus*).

Narcissus Trimon ×.—Sir M. Foster's hybrid between *N. triandrus* and *N. monophyllus.* It is the earliest of all in flowering this year. The preceding are flowering out of doors.

Cyrtanthus lutescens.—Mr. O'Brien, V.M.H., contributed the following remarks upon this plant:—"About the year 1893 Mr. J. Medley Wood, of the Botanic Gardens, Durban, sent me a few small bulbs of a Cyrtanthus, afterwards described by Mr. J. G. Baker in the *Gard. Chron.*, June 9, 1894, page 716, as *Cyrtanthus O'Brieni*, from a specimen from the Drakensberg which flowered with me. Prior to that I got *C. lutescens* from the same region, and either at the same time as *C. O'Brieni* or soon after, a rather showy Cyrtanthus (also from the same region), which Mr. Baker said was nearest to *C. Tucki*, though it was a much nearer approach to the showiest forms of *C. angustifolius* than the original *C. Tucki*, which, by crossing with *C. lutescens*, gave me *C.* × *Marian*, in describing which I gave also some other experiences with Cyrtanthus, which may or may not coincide with the experience of others. *C. O'Brieni*, imported, was always delicate, and ultimately died. Before that event I had crossed *C. lutescens* with the Drakensberg species, allied to *C. Tucki*, and on its flowering I was pleased to find that it was practically identical with the imported *C. O'Brieni*, but much freer growing. I think it points to the probability of the wild *C. O'Brieni* being the result of a natural cross between the two plants from which I got it at home. I think that view is strengthened by the fact that *C. O'Brieni* of Natal is only found in the one unfrequented spot, and, so far as I can glean, only in a small patch. All the plants referred to are of the Monella section of Cyrtanthus. I may say, in justice to Mr. Baker, that the many points of resemblance between my *C.* × *Marian* and my *C.* × *O'Brieni* go far to prove the correctness of the name 'variety of *C. Tucki*' given by him."

Urceocharis Clibrani × (fig. 86, *Gard. Chron.* xxvi. p. 251).—This is a bigener between *Eucharis grandiflora* and *Urceolina pendula.* Mr. Elwes, F.R.S., called attention to the fact that the green tint characteristic of the Urceolina is only transitory in the hybrid, being present in the bud but not in the fully developed

flower. Mr. O'Brien, V.M.H., added the following observations on the point:—"The point commented on applies in a more or less degree to most hybrids—viz., the varying evidence of one or other of the parents in the different stages of the growth of the flower. In the buds of the Urceocharis, the yellow and green colours of *U. pendula* are strongly shown. So also is the form of the bud of Urceolina. As the flower matures, these characters gradually get obliterated by the influence of *Eucharis grandiflora*, until, in the mature flower, the yellow colour and most of the green has departed, and the white of the Eucharis asserts itself, the chief indication of Urceolina being the ventricose form of the perianth. The vanishing of the colour, where white or some of the fainter tints are used on the one side, is, I think, a natural consequence, as the colour of the coloured species is mostly surface colour."

Dioscorea sativa.—This bears tubers (one of which was sent) at every joint, for a length of 40 feet. The tuber, which was globular, would send out a shoot 3 or 4 feet or more in length if kept indoors.

Kola acuminata.—A flowering shoot of this tree which bears the Kola nut. The calyx is orange-coloured, the corolla is wanting, and the leaves are dimorphic, like that of the Fig, &c.

Aloe sp. nov.—This is said to agree with specimens collected in Somaliland. It was taken to the Natural History Museum for identification.

Heterotoma lobelioides.—The Bird Plant of Mexico; the flower is remarkable for the receptacular tube extending as a beak in front, carrying two small sepals at the extremity, and the tubular corolla adherent to it throughout.

Cornus mas.—Flowering from the middle to the end of January, even on to March. *Hamamelis virginiana.*—Wych Hazel; the nut is eaten in Virginia, and is regarded as a valuable medicine there. *Hardenbergia Comptoniana.*—A very pretty climber for a greenhouse. *Siphocampylus lanceolatus.*—A quite uncommon plant. *Distiacanthus scarlatinus.*—A brilliant Bromeliad.—*Crocus Imperati*, *C. chrysanthus*, and *C. Sieberi.*—Winter-flowering species, now nearly over.

SCIENTIFIC COMMITTEE, FEBRUARY 26, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and fifteen members present.

Double Tulips.—Mr. Houston exhibited and commented upon an early double Tulip, pointing out that the filaments of the stamens became petals (as in the Water Lily), and that from his experience a dry poor soil appeared to be conducive to the process of doubling. Stock seed, for instance, gave 90 per cent. of doubles under those conditions. On the other hand, Mr. Wilks observed that *Papaver Rhœas* become double in a rich garden border, but rarely, if ever so, in the wild state. Professor Boulger remarked that he had found *Ranunculus acris* and *Geum rivale* often double in moist places; *Cardamine pratensis* has also occurred double in similar situations. Mr. Douglas's experience was that Carnations raised in pots gave many more doubles than when in the open border, only 10 to 12 per cent. being single. This would seem to agree with Mr. Houston's experience. Professor Henslow drew attention to the

fact that it was long ago asserted by Mr. William Masters that a suspension of vitality must take place before a flower is formed, whether single or double; that mere vegetative vigour is not the cause of doubling, but that when once the doubling has been developed, and, as Mr. Masters said, "is constitutional or in the blood," then abundant food will favour the development of double flowers. Mr. Masters gives the following instance in the case of Balsams: "One year we did not pot the plants off from the seed pots for many weeks after they were ready. They were, in fact, starved before being transplanted, and only produced single flowers. I treated them liberally, and they then bore flowers as double as could be wished." Mr. G. Duffield some years ago produced double Lapagerias, and noticed that both a white and a red-flowering plant, growing side by side, bore double flowers in the same year, and remarked that it seemed curious, as the plants were by no means remarkable for vigour. This, however, was apparently the cause. Mr. Laxton has also observed with regard to double Peas: "I am of opinion that a check during the growth of the plant, either from drought, frost, or even injury to the stem, may produce it. Hitherto all the double-flowered forms have been produced later in the season, just as late or second blossoms of Apples and Pears are frequently semi-double, while the early flowers of zonal Pelargoniums have often from six to ten petals." From Goebel's observations, double-flowered Stocks can be raised from seed of single-flowered up to 90 per cent., if the smaller and abnormally formed seeds are selected. Other testimony of a similar kind might be quoted in corroboration.

Distorted Growth of Yews.—Mr. J. W. Odell exhibited specimens, and observed that Yew trees in his district (N.W. Middlesex) are very much disfigured by the formation of cone-like galls. These are due to the gall-fly, *Cecidomyia taxi* (Inchbald). The specimens were from several trees. On young trees the gall seems to be more persistent than on older trees. On the former the leaves forming the cones appear to recurve after the pupæ escape, assuming a rosette-like appearance, and, beyond the arresting of the growth of the shoots affected, no great harm seems to be done. On the older trees the cones and rosettes drop off rather freely, and this often gives a shabby look to the tree, as the shoots die back and decay.

Crested Ferns, &c.—Mr. C. D. Druery, V.M.H., exhibited the following specimens: 1. Fronds of *Phegopteris hexagonoptera truncata*, found by Mr. Maxon (Smithsonian Institute) on the banks of the Potomac in 1900. Living plants are in the exhibitor's possession. All the terminals are abruptly truncated with excurrent midribs like slender thorns. 2. Fronds of a partially bipinnate form of *Nephrolepis exaltata*, from Mr. Roupell. Many of the central pinnæ are much elongated and thoroughly bipinnate, resembling small fronds. These fronds were taken about three years ago, but Mr. Roupell states that the plant has since resumed its normal pinnate type. Sowing the spores was suggested with a view to obtaining a decompound strain of this species. 3. Fronds of three distinct varieties of three distinct species, found growing together in one clump in a wood near St. Austell, Cornwall, by Mr. Williams. They represent: (*a*) A small crested form of *Lastrea pseudo-mas*, and it is worthy of remark that the well-known *L. p.-m. cristata* (king of male Ferns) was found in

the same locality; (*b*) a polydactylous, foliose form of *Polystichum angulare* of very distinct type from the normal, but imperfectly polydactylous; (*c*) an extremely fine bipinnate form of *Polypodium vulgare*, with basal pinnules over 2 inches long, and deeply cut throughout. Mr. Williams stated that the remaining fronds were very much larger, but damaged, which indicates a very abnormal size, as well as development. Such an association of varieties is certainly quite unique, so far as any record is concerned, and as all three are redundant, the conditions of growth must be peculiarly favourable, which may have induced the "sports." The *P. vulgare* is quite distinct from previous finds; the other two have been closely paralleled. *Pteris aquilina cristata*, found by Mr. C. B. Green, Acton, at Faygate, Sussex. Some acres of this form exist near the railway station, intermingled with about 50 per cent. of normal fronds.

Rhamnus californicus sp.—Mr. E. M. Holmes exhibited a specimen of *Rhamnus californicus*, showing that the leaves in this species are evergreen, whilst the nearly allied species, *R. Purshianus*, loses its leaves in the autumn, the majority of the species of this genus being deciduous. The bark of both species is collected, and is known in commerce as "cascara sagrada." Attention was also directed to the fact that the bark, met with in commerce under the name of *Salix nigra*, does not possess the appearance of the bark of that species, of which the young twigs are black and polished, and have at first a waxy bloom on them. The bark of commerce more nearly resembles that of *Salix alba*. Mr. Holmes also brought seeds (stones) of *Prunus nepalensis*, which he had received from Dr. Geo. Watt, C.I.E. (Reporter on Economic Products to the Indian Government), as worthy of cultivation in this country, the fruit having a pleasant acid taste, and being used as a fruit in Nepal.

Croci, sp. and vars.—Mr. E. A. Bowles exhibited the following interesting series of Croci. The type forms and albino varieties of *C. reticulatus*, pure white, except for a line or two of greyish-blue at the base of the segments and extending down the perianth tube. (For some years I could not identify this variety with certainty, until one bulb in 1899 reverted to a striped form identical with the *C. reticulatus v. albicans* of Herbert, figured in the "Botanical Register," vol. xxxiii. 16 (17), fig. 2.) 2. *C. Imperati.*—Pure white internally, externally pale buff, almost white, and richly feathered with deep purple on the outer segments. The seedlings raised from this form produce the typical Imperati, with diphyllous, proper spathe. 3. *C. versicolor.*—A form often confounded with Imperati and known as *Imp. v. albidus.* The inner segments distinctly show the feathering so characteristic of versicolor, the form of Maw's, plate xvi., fig. 1, d. I have wild forms, collected near Mentone, which very nearly approach this, and, like this, they have a ligulate inner proper spathe. 4. *C biflorus v. Weldeni.*—A pure white form, sold as *Weldeni v. niveus* and *dalmaticus niveus*. *C. candidus.*—Typical forms, white grained with blue externally, and the new yellow variety, clear orange grained externally with purple; a very floriferous and beautiful form. *C. cyprius.*—A small blue species with rich purple bases to the segments on the outer surfaces. The only species that has scarlet filaments. It, unfortunately, appears to have a delicate constitution in cultivation. *C. corsicus.*—Proper spathe monophyllous. *C. minimus.*—Proper spathe

diphyllous; both natives of Corsica, the former in mountainous regions, the latter in lower ground. *C. reticulatus v. micranthus.*—A small-flowered form, much deeper lilac internally. 5. Seedling varieties of *Crocus chrysanthus*, approaching most nearly to the *v. cærulescens.* It is the first year of flowering, and this perhaps accounts for the small blossoms. Two of these, internally, pure white with a bright orange throat; the outer surface of the outer segments is suffused with a rich crimson-purple with the exception of a narrow marginal band of a pale cream colour. The other has the outer segments sulphur-yellow, slightly paler on the inner surface, and grained with dull purple down the centre on the outer surface. The black spot at the base of the barbs of the anthers, so characteristic of *C. chrysanthus*, is present in this form and one of the former, but absent in the third specimen.

Swede Turnip, budding from root.—Mr. Wilks exhibited a root with two or three tufts of shoots springing from apparently the true root. It is not a very uncommon occurrence, and was probably due to some check from local injury, &c. A remarkable instance was figured in *Gard. Chron.*, Feb. 3, 1877.

Phalænopsis weevil.—Mr. Chapman brought specimens of this insect. The only remedy that could be suggested was a careful search for them at night.

Epidendrum longicolle.—Mr. O'Brien, V.M.H., exhibited flowers in a malformed state. Dr. Masters undertook to examine and report upon them.

Pinus tuberculata.—Dr. Masters exhibited a branch with cones of this handsome W. American Pine, now sometimes called *P. attenuata.* It is one of the species the cones of which remain for some years upon the tree, and only shed their seeds after a forest fire.

Winter Aconite germinating.—Prof. Henslow showed specimens of *Eranthis hyemalis* to illustrate the apparently abnormal fact of the tuber being first formed on the slender tap root, and not on the caulicle.

The "Armoricæ," or "Atlantic" British Plants.—Prof. Henslow commented upon these terms: "Armoricæ" was given by Ed. Forbes to plants found in Normandy, the Channel Islands, and S.W. England, as well as up the west coast to Scotland; whilst "Atlantic" was the name given by H. C. Watson. Prof. Henslow pointed out that the true source of such plants is the S. European or Mediterranean region, and at the same time exhibited specimens of the *Ranunculus ophioglossifolius* of Jersey (now extinct), brought from Hyères, and from Malta, as well as other plants illustrating the same fact.

Scabious bracts virescent.—Prof. Henslow exhibited specimens in which the florets were suppressed, but the bracteoles had become elongated and sub-foliaceous. This peculiarity is comparable with the green Dahlia, wheat-eared Carnation, &c.

SCIENTIFIC COMMITTEE, MARCH 12, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and nineteen members present.

***Double Flowers, production of.*—Mr. Douglas contributed the following additional observations on this subject. He said, "I can speak of**

the Carnation and Picotee only from my own experience, and from what I have seen of the garden or German Stock. I have worked upon the Carnation over thirty years, raising a considerable number annually, and always saving the seed from the best double flowers, and from the very best varieties in the various classes. Taking the average of seasons, I get 5 per cent. double flowers as good as the parents, 12 per cent. single flowers, of every shade of colour favoured by the Carnation. This leaves 83 per cent. of flowers which are double but which are in no respect equal in form, &c., to the parents. The finest lot of choice varieties I ever had was in a hot, dry season. The plants were well supplied with water, and many one-year-old plants produced upwards of 200 blooms each. I remember discussing the production of Stock seed some ten years ago with Mr. John Ward, then, as now, a market grower at Leytonstone in Essex. Speaking from his own experience, he informed me that he always obtained the largest percentage of double-flowered Stocks when he saved the seed from plants grown in pots. Subsequently I was being shown over a large establishment in Germany, where an enormous quantity of seed is annually saved, and I found that all the best ten-week Stock seed was saved exactly as Mr. Ward saved his in Essex. Thousands of flower-pots about 5 or 6 inches in diameter were arranged on a wooden stage fully exposed to the open air, and I was distinctly informed that it was necessary to grow the plants in this way to make sure of the seed producing a large percentage of double flowers. The Poppy has a greater tendency to produce double flowers than any other plant known to me, and certainly the tendency is greater in rather exhausted soil, as can easily be proved by allowing a bed to sow itself from the previous year's bloom, and the plants to flower on the same ground without making an addition of soil or manure to the bed." Mr. Wilks remarked, "If that be so, ought not all the Poppies in our corn fields to have become double long ago?"

Abutilon Hybrids.—Professor Marcus Hartog sent the following communication, with specimens, from Queen's College, Cork:—"I send you herewith specimens of some of my new Abutilon hybrids. The male was *Abutilon megapotamicum*, and the mother-plant a hybrid of the Darwinii 'Boule de Neige' type, which we called 'Petticoat,' from its wide-open habit. This plant is an exceptionally free seeder; its flowers are orange, streaked with brown, and its leaves show very little trace of variegation. The hybrids all show a marked transverse depression at the insertion of the deltoid calyx-lobes on the tube, and most of them show colour in the calyx, like the male, and some sign of deep red or purple spotting in the depths of the corolla, which in most plants is elongated like the sire. The one that I have called 'Blanche' has a much more spreading corolla, of more substance than the rest, with a clear tendency to become pleiomerous—to double, in fact.

"*Variegation* is very irregular, even in the open ground, and becomes very slight in the winter quarters. It appears as a margination, gradually increasing till the only dark green parts lie along the greater veins. Again, in the open, some of the plants exhibit a marked purpling of the parenchyma on either side of the veins, which I have seen in no other Abutilons.

"All these hybrids agree in possessing a much more free-branching habit, with greater fulness of growth than any others that I know. The more erect ones send out more numerous lateral branches, and do not become 'leggy,' while the spreading ones produce numerous branches that fill up the centre of the plant, and keep it from looking straggling. The summer flowers are at least half as large again as the winter ones that I send. The plants were raised from seed in the autumn of 1899, kept through the winter in a cold orangery, where they made no progress to speak of, and were planted out at the end of May last year. In the autumn they were potted off, and have been kept in a greenhouse, far too crowded for them to do well. I may note that among the Abutilon hybrids that we have, the roots are almost always swollen with galls, produced by the nematode *Heterodera radicicola*, with which the mould *Thielavia Hartogi* (Butler) co-operates. These galls formed the subject of an interesting research by Dr. Butler, now cryptogamist to the Indian Government, and a preliminary abstract of it was published in the British Association Report for 1900 (Dover). I have found the addition of soot to the soil useful in checking this disease, though I am not sure that it stops it.

"I take the opportunity to show an inflorescence of a hybrid *Saraca* (*indica* × *tetrandra*), raised by the late Wm. Crawford at Lakelands, Cork, and acquired by gift from his executors when the collection was broken up at his death. These hybrids, of which we have five distinct forms, are singularly ornamental shrubs for the stove, where they flower for nearly three months, beginning in February."

Carnation leaves decayed.—Mr. W. B. Vernon, of Oswestry, sent some leaves, decayed at the tips, of a pink Malmaison, observing that the browning of the apex of the leaves occurs almost every year about this time. They were sent to Dr. W. G. Smith for examination and report.

Late-flowering Chrysanthemums.—Mr. Holmes sent a blossom of "Lady Canning," with the following observation:—"I have never seen a flower so late as this before. It was in a pot in a cold house, and has been in blossom since the week before Christmas. I also send a fasciated stem of *Daphne Cneorum*."

Snowdrops, Diseased.—Dr. W. G. Smith sent the following report upon specimens submitted to him:—"I regard the Snowdrops sent from last meeting of the Scientific Committee as attacked by the Botrytis stage of the fungus *Sclerotinia galanthi*. This was described and figured by Mr. Worthington G. Smith in 1889; Mr. George Massee also describes it in the *Kew Bulletin*, No. 124, and in his latest text-book of plant diseases. I found the Botrytis form of spore working its way up the green parts of plants sent; now these are a shapeless mass with the Sclerotium stage present in numbers. As to remedy, I can suggest nothing better than to lift the bulbs after flowering, and before planting them again in the autumn to shake them well in a bag with flowers of sulphur."

Mistleto in the Oxford Botanic Gardens.—Inquiries having been made as to the origin of the numerous plants and varieties of *Viscum album* now on various trees in these Gardens, the following observations have been received from Mr. T. E. Jefferies, Oxford:—"I understood from the late Mr. W. H. Baxter that his father established the plant on Apple trees

growing in a slip of ground outside the garden western boundary wall many years ago. Now it is met with in, or adjacent to, the Gardens on perhaps a greater number of different kinds of trees than could be seen in a similar area anywhere, and probably the diversity of their forms is equally exceptional. On fresh specimens the size of the fruits varies considerably, the largest fruited plants being rendered far more striking as regards their whiteness, or, as may be said, their effective translucent appearance, more especially where they aggregate in clusters and become distinguished by being so prolific. Mr. Burbidge records the fact of Viscum growing on the following trees:—"*Ostrya vulgaris*, Horse-Chestnut, *Pavia flava*, Lime, Maple, Hawthorn, Apple, Willow, Beech, and *Viburnum sp.*, but very weakly on the last two. Outside the Gardens it grows on two Poplars."

Cattleya, Monstrous.—Mr. Coleman exhibited a form of Cattleya, which Dr. Masters undertook to examine.

Leopard Moth.—Mr. Gordon referred to the damage done by the caterpillars of this moth in boring up branches of the Spanish Chestnut, Apple trees, &c. He asked for information as to how long the caterpillar lived. Mr. McLachlan observed that the caterpillar really bored upwards through the pith, and not downwards, as is usually supposed. The only remedy was to insert a wire and kill it by probing. The fumes of cyanide of potassium was another remedy, if they could effectually reach the caterpillar. As to the duration, two seasons were required to complete the transformation, while the goat-moth caterpillars took three years.

Apple, Rotten.—Mr. Houston exhibited a remarkable case of decay, which had begun in the centre and spread uniformly outwards, so that the sound part came away like a hollow shell, leaving a perfectly spherical decayed central mass. There was no apparent fungus or other cause to account for it.

Crinum sp.—Mr. Worsley exhibited some stolons of a species of Crinum known as *C. jamaicense*. It is found in Jamaica, on the N.E. coast, near the sea, exposed to the N.E. trade winds. It is an unrecorded species, and since the peculiar method of propagation by fleshy stolons, one joint of which swells into the bulb, is characteristic of North America, it was Mr. Worsley's opinion that it was derived from that country, by ocean currents floating the seeds, or perhaps bulbs, to the shore of Jamaica.

Specimens from Trinity College Gardens, Dublin.—The following specimens were received from Mr. Burbidge, V.M.H., with the following remarks:—"1. Herewith I send two or three sheets of Birch-bark paper, from *Betula utilis*, D. Don (= β *Bhjopattra*, Wall). It is written that paper was first invented and made by the Chinese; but I suppose the Birch trees of both East and West (*vide* Longfellow's poem of 'Hiawatha'), to say nothing of the wasps, made paper long before even the Chinese! Note how sensitive it is to heat and moisture. It is difficult to prevent its becoming a natural scroll. Was it the origin of all scrolls of bark, and afterwards of animal skins, used as a writing surface or paper? We have three trees, the largest 20 feet high, and we value them very highly, not only for their silver-stemmed beauty, especially during winter, but especially because they were born and raised

here from seeds, which Sir J. D. Hooker, K.C.S.I., sent to the Gardens eighteen years ago. In the same packet came seeds of the Himalayan Bird Cherry, *Prunus* (Padus) *cornuta*, with its old bronze-coloured bark, now 25 feet high, and it flowers and fruits freely every year.

"2. Flowers of the old greenhouse plant *Canarina campanulata*, of the Canary Islands, *vide Bot. Mag.* t. 444.

"3. *Salvinia natans*. As to this, note its waterproof coating of short hairs, which carries down an air film if the plant be temporarily submerged; note also its lifeboat-like habit of 'righting' itself when placed in a vessel of water. Like Duckweed (Lemna), Azolla, and other aquatics, it robs all submerged plants of light, &c., by its (and their) habit of forming a dense green mosaic on the surface of the water. Azolla kills or crowds out *Lemna minor* here, in sheltered open-air tanks.

"4. *Acacia sphærocephala* (?= *A. cornigera*), 'Buffalo-horn Acacia,' myrmecophilous (*vide* Belt's 'Naturalist in Nicaragua,' London, 1874). Note the big hollow spines, in which the ants live; and also the yellow waxy secretion and exudation at the tips or apices of the young leaflets. I do not think this substance has received any chemical study. This 'ant-manna' seems to be of no actual or direct service or relief to the Acacia, as are some secretions; the resinous secretions that at times close the absorptive and secretive glands on the leaves of *Rosa alpina* for example. In any case, it would be a step forward to know exactly what this yellow wax-like leaf product really is.

"5. An Indian 'Dodder,' growing on Ivy in cool greenhouse here, *Cuscuta reflexa*: Hooker, in 'Himalayan Journals,' Minerva Library, 1891 edition, p. 27, says:—'Dodders (Cuscuta) covered even tall trees with a golden web.' This species is so rampant that it might have been one of them. It will grow on Ivy, Pelargonium, Cotoneaster, Calceolaria, Carex, Jasmine, Forsythia, Cytisus, Fuchsia—indeed, nothing seems to come amiss, and it is even self-parasitic (like the Mistleto), this phase of its life-history having been discovered by Dr. Henry H. Dixon, of the Physiological Laboratory, Trinity College, Dublin, a few years ago, and described in the 'Proceedings of the Royal Irish Academy,' as also in 'Notes from the Botanical School of Trinity College, Dublin,' No. 4, January, 1901, chap. xvii. p. 146. The plant flowers freely late in summer or autumn, the flowers being white, and not unlike those of a small Lily of the Valley (Convallaria), having a honey-like perfume, which is very attractive to flies of many kinds.

"6. *Azolla filiculoides*, on water in muddy outdoor tanks here, is now a lovely copper-red colour. I see Hooker (*loc. cit. supra*), p. 255, mentions Lake Catsuperri, alt. 7,150 feet, bordered by a broad marsh of Bog Moss, in which was abundance of Azolla, colouring the waters red."

Scientific Committee, March 26, 1901.

Dr. M. T. Masters, F.R.S., in the Chair, and nineteen members present.

Cattleya, Monstrous.—Dr. Masters described the specimen sent to the last meeting as follows:—The flower is dimerous, in having two sepals, a lip, a lateral petal displaced so as to be situate in the centre, at the back of

the flower, in the position usually occupied by the dorsal sepal, and a normal column.

Cypripedium illustrations.—Mr. G. S. Saunders showed a series of beautifully executed water-colour drawings of malformations in the flowers of this genus as follows :—The entire absence of one or of both side petals ; the entire absence of the labellum, its presence in a distorted form, and its partial or entire duplication ; one or both side petals partially, or entirely, taking the form of the labellum ; the side petals joined to the upper or lower sepals ; the upper and lower sepals joined together ; one side petal adhering to the labellum ; the lower sepal adhering to the labellum ; a duplication of parts ; a double flower, caused by the adherence of two flowers ; a flower showing the two lower sepals separate which are generally joined together in this genus.

Acotyledonous members of Amaryllideæ.—Mr. Worsley gave some account of his observations as follows :- Among Amaryllideæ acotyledonous species occur in the genera Crinum, Hymenocallis, Elisena, and probably in Griffinia and several Andine Pancratia. He does not think it is constant even in one species. Among the Crinums it occurs occasionally in *C. Moorei* ; frequently, or almost invariably, in Ismene and Elisena, but rarely, if ever, in Hymenocallis true. Plants from regions of annual droughts gain advantage by immediately forming a bulb at some depth under the soil, which will not break into growth until the rains return, and will thus commence their annual growth at the best time. In the absence of specimens and illustrations it was impossible to form an opinion as to the peculiar and anomalous conditions described. Orchids and parasites, &c., Dr. Masters observed, are without cotyledons, because the perfect embryo is not formed. Mr. Worsley also described the usual curvature of the radicle, or "geotropism," characteristic of all seed germinating in the ground. He also described how a bulb will be formed at the bottom of the flower-pot. This, Dr. Masters remarked, was probably the well-known formation of a "dropper," so common in Tulips, &c., the new bulb being formed in a leaf-sheath.

Ferns, Anomalous.—Mr. Druery exhibited the following remarkable specimen :—Fronds of *Polystichum angulare* var. *sinuosum*, sent by Rev. H. Kingsmill Moore, Dublin. It is unique in having all the fronds evenly flexuose at short intervals in the plane of the frond. In this respect it is quite distinct from the several flexuose forms already found, they being generally distorted, a fact which in pressed herbarium specimens is masked by pressure. The fronds exhibited were unpressed, as received. The Fern was found wild many years ago in Ireland by Mr. Davey.

Hybrid Orchids.—Mr. Douglas brought some hybrids "for the purpose of showing that Orchids which flower naturally at the same period of the year produce satisfactory results, whereas if crosses are effected between species that do not naturally flower at the same period, the results are unsatisfactory." As an example of the latter he referred to Lælia × Briseis, a cross between *Lælia purpuràta* ♂ and *L. harpophylla* ♀. He observes, "The seed did not germinate freely ; two plants only were obtained from what seemed a very satisfactory capsule. Both plants are natives of Southern Brazil. *L. harpophylla* produces its flowers under cultivation in February and March ; its flowers are small, 2 to 3

inches across, of a bright cinnabar-red colour, and altogether unlike the gorgeous *L. purpurata*, with coriaceous leaves 12 to 15 inches long, having flowers 6 to 8 inches diameter of an amethyst-purple colour. The only trace of this colour in the progeny is a slight tinge on the lip, and in no respect is there anything to lead one to the conclusion that *L. purpurata* was the parent. The plant is very much larger in all its parts than *L. harpophylla*, but not nearly approaching even the intermediate size of *L. purpurata*, either in flower, leaf, or pseudo-bulbs. Can any reason (other than the fact that the two species do not flower at the same season of the year) be shown why the seedling is not intermediate between the two parents?" He also exhibited flowers of *Cymbidium eburneo-Lowianum*, with flowers of the seed parent, *C. Lowianum*, and of the pollen parent, *C. eburneum*. "In this case the two parents naturally produce their flowers at the same time, and the result of hybridisation is entirely satisfactory. The pseudo-bulbs and leaves are as intermediate as are the flowers. The flower-spikes are longer than those of *C. eburneum*, but not so long as in *C. Lowianum*. In the one case the result was disappointing, in the other very satisfactory; moreover, it has been asserted that such results are to be expected. May I ask why?"

Dendrobium Leaves, Spotted.—Mr. Douglas remarks:—"The leaves of Dendrobium, freely covered with black decayed spots and blotches, have puzzled me greatly. I had a few plants sent me which developed the disease, and it speedily spread to my own plants, which had been quite healthy. I lost several altogether, as it also developed on the stems. There does not seem to be any fungus on the diseased parts, and yet by no manner of treatment can I get rid of this pest."

Cattleya Trianæi, Monstrous.—Mr. Douglas observes:—"The flower of *Cattleya Trianæi* was sent to me by the Rev. Francis D. Horner. It is abnormal as regards colour, but it has been constant for six years."

Turmeric Tubers.—Mr. Holmes exhibited fresh specimens, an unusual condition; as a marketable product they arrive generally in a dried condition. They are the old tubers of *Curcuma longa*; the young ones are white, and contain starch.

Plants from the Botanic Gardens, Cambridge.—Mr. Lynch sent the following interesting species:—*Arctotis, sp. n.*, a fine plant, sent to Cambridge by Mr. Gumbleton; it somewhat resembles *A. glaucophylla*. *Melasphærula graminea*, a curious and graceful Irid, charming among bolder flowers. There are two forms, one having pale yellow flowers, which is rare; the other has darker tinted blossoms. Hybrid Sarracenias. —These showed variations of colour, according to those of the parent species as follows:—*S. purpurea* × *S. flava* = *Stevensii*; *S. rubra* × *S. purpurea* = *Chelsoni*; *flava* × *Stevensii* = *illustrata*; *Chelsoni* × *illustrata* = hybrids sent. *Laportea moroides.*—This plant had a large bunch of Mulberry-like fruit, but paler in tint; it bore numerous stinging hairs, the leaf also resembled that of the Mulberry tree. It belongs to the tribe Urticeæ of Urticaceæ. It is figured in *Bot. Mag.* 1889, t. 7057, and is a native of N. Queensland, where it is said to cause the death of horses. *Deherainia smaragdina.*—A native of Mexico; a tree of the order Myrsineæ, remarkable for its dark green flowers, the corolla having chlorophyll. There are foliaceous, rudimentary stamens alternating with

the petals, as in Brookweed (Samolus), of the allied order Primulaceæ. The anthers are extrorse, dehiscing, while forming a central, erect column, but spreading on the petals subsequently. It is figured in *Bot. Mag.* t. 6373. Fungi.—Mr. Lynch also sent some specimens of *Peziza lanuginosa* (described as *Sepultaria Sumneriana* in Massee's "Fungus Flora"), growing in the grounds of the Cambridge Botanic Garden.

Scientific Committee, April 9, 1901.

Dr. M. T. Masters, F.R.S., in the Chair, and thirteen members present

Pseudo-fasciation of Ash.—A specimen was exhibited of a diseased Ash-bough by Mr. Odell, who described it as follows:—"This is a diseased condition of the inflorescence resulting in the fusion of the pedicels into a thick and shapeless mass, which hardens into quite a woody structure. These sub-fasciated clusters are said by Professor Kerner, and also by Mr. A. Murray, F.L.S., to be due to the attacks of a minute Phytoptus. The accompanying specimens were obtained from trees growing by the river Ouse at Olney, in North Bucks, where I recently observed that this diseased condition was common to the Ash trees growing along the valley of the Ouse; in some cases only slightly, in others the trees were thickly covered with the 'fasciated' clusters. It did not appear that the trees were in any way stunted or affected by the disease; but as the result is to prevent the development of seed, it may be that the vegetative processes are stimulated by the partial and abnormal suppression of the reproductive functions." The condition is figured in Masters' "Vegetable Teratology," p. 421.

Masdevallia, sp.—Mr. Chapman brought the following species, upon which Dr. Rendle reports as follows:—"*Masdevallia Lowi*, Rolfe (*Gard. Chron.* 1890, 416), is said by Miss Woolward, in her monograph of the genus, on Consul Lehmann's authority—'who has had the advantage of examining Prof. Reichenbach's dried specimens'—to be the same as *M. trinema*, Reichenb. f., 'Flora,' 1886, 538. As *M. Lowi* was not described till after Prof. Reichenbach's death, when his dried specimens could no longer be consulted, Consul Lehmann's opinion would seem to be based on memory. A comparison of the flower of *M. Lowi* with the description of *M. trinema* suggests that Mr. Rolfe was justified in regarding his plant as a distinct species. The sepal tails of *M. trinema* are said to be much longer than the triangular bodies, whereas in *M. Lowi* they seem to be always markedly shorter. The bidentate tip of the column marks another discrepancy, that of *M. Lowi* bearing several fimbriations. Moreover, Reichenbach's statement that the dimensions of *M. trinema* are those of his *M. Gaskelliana*, points to a smaller flower than that of *M. Lowi*."

Cypripedium with two lips.—Mr. Chapman also showed this not uncommon phenomenon. As the flower had three sepals and two petals beside the lips, the result had occurred in consequence of, or in correlation with, a bifurcation of the axial cord belonging to the lip. This was borne out by a dissection of the flower.

Poterium spinosum.—Mr. Saunders exhibited a plant of this species

covered with spiny branches and minute leaves with inrolled margins. These features are very characteristic of many plants growing in deserts and other excessively dry localities. It is a native of Palestine.

Epidendrum hybrids.—Mr. Veitch exhibited and described the following new hybrids:—*E. Wallisi* × *E. Endresi* = *E. Endresio-Wallisi.* This hybrid × *E. Wallisi* = *E. elegantulum*, *E. Wallisi* × *E. elegantulum* = *E.* 'Clarissa.' *E. Wallisi* grows to a height of 5 or 6 feet, whereas *E. Endresi* is not more than about 1 foot in height. The first hybrid was about 2 feet in height; the second, *E. elegantulum*, grows to a height of 3 to 4 feet. There are many varieties among the 'Clarissa' progeny, one being much finer than all the rest, called *C. superba.* *E. Endresi* is a native of Costa Rica, and *E. Wallisi* of New Grenada. The hybrids partook more of the characters of the flower of *E. Endresi* than of those of *E. Wallisi*, which has a much larger blossom than the former.

Peduncles of Grapes becoming Tendrils.—Mr. Hudson exhibited some specimens from a vinery in which the whole crop had degenerated into quasi tendrils, but bearing small groups of buds upon them. It is well known that peduncles and tendrils are homologous in the Vine, and therefore interchangeable. The cause was presumably an arrested growth from chill, as the roots were said to be healthy.

Fasciated Stems.—Mr. Burbidge sent a series of examples of this peculiarity, remarking upon a bunch of *Cotoneaster microphylla*, which had the buds continually rubbing on a roof, that this irritation possibly caused the fasciation, adding, "I am led, after considerable observation, to believe that irritation of, or injury to the normal terminal or lateral buds, whether by friction, insects, or other causes, is at the bottom of the phenomenon." He adds that "besides being hereditary from seeds in the Cockscomb, the 'Stag's-horn' Ash—a fasciated condition—can be perpetuated by grafting." Mr. O'Brien referred to his experience that Ferns standing near the entrance of a conservatory, and continually "brushed" by passers, become more or less fasciated and crested. Mr. Druery mentioned how Ferns if tripinnate became crested. Mr. Hudson observed, that of some Water Lilies which produced fasciated stems, portions of the rhizomes were transferred to Kew; they also produced them there, showing that fasciation may be an acquired habit, and transmitted either by the vegetable or reproductive organs.

Fasciation and Allied Phenomena.—Mr. Henslow explained how fasciation arose from a continual bifurcation of the fibro-vascular bundles of the stem without forming cylinders for axillary buds. A similar cause gave rise to "multifold" flowers as distinct from "synanthic." It also applied to fimbriated and crested flowers, as well as multifold axes in Pears and carpels in Tomatos. Being an "affection" it would be hereditary, as in the Tomato and the campanulate terminal flowers of Foxgloves. (See p. 160.)

Scientific Committee, April 23, 1901.

Dr. M. C. Cooke, M.A., LL.D., in the Chair, and twelve members present.

Peziza tuberosa.—Mr. Holmes exhibited specimens of this fungus, consisting of funnel-shaped cups, of a bright brown colour on an

elongated stalk, arising from an irregular black tuber-like sclerotium. The mycelium preceding the sclerotium stage is said to be parasitic on the Wood Anemone.

Virescent Primroses.—Mr. Holmes also showed flowers with slightly abnormal calyx, but with a virescent corolla. There were no stamens, but the pistil was malformed, being open and terminating above with styliform processes. In one, a portion of the placenta was parietal, the free portion carried a minute tuft of a foliar nature at the summit.

Helxine Soleirolii.—Mr. Odell brought a specimen of this plant of the family Urticaceæ. It is a native of Corsica, having very small leaves, and minute male and female flowers, somewhat resembling those of a Stinging Nettle. It is monœcious.

Schinus Molle Diseased.—Dr. Bonavia sent some leaves of this tree apparently diseased. Dr. M. C. Cooke undertook to examine them.

Carnation Leaves Injured.—Dr. William G. Smith reports on the specimen sent to him as follows:—"On March 18 you sent some Carnation leaves with diseased tips. After examination I find no sign of fungi. It appears to me that the disease is due either to water remaining on the tips after overhead watering, or to exudation of water at the tips. As only the ends of a few leaves were sent, no examination of the rest of the plant could be made. Useful suggestions on Carnation diseases —including, I think, this one—will be found in Vol. xxv., p. 88, also a report of my own in Vol. xxxiii., p. 29. A paper by Woods (U.S.A. Dept. Agric.), which deals with a bacterial disease, would also furnish useful hints on treatment."

Oleander Diseased.—Dr. W. J. Russell sent some leaves growing on "fine and hitherto very healthy pink-flowered plants in a conservatory; but while the rest of the plant looks healthy, several of the branches are fading, the attack coming from a point close to the main stem." They were forwarded to Dr. William G. Smith for further examination.

Mistleto at Oxford.—Mr. W. G. Baker writes as follows with regard to this subject:—"With reference to the Mistleto in the Botanic Gardens, I cannot find it recorded when it was first introduced. The following list contains all the trees upon which it grows here:—Vigorous: *Cratægus Oxyacantha*, *C. O.* var. *rosea*, *Ostrya vulgaris*, *Æsculus* (Pavia) *flava*, *Cladrastis tinctoria*, *Tilia vulgaris*, Apple tree. Moderate: *Cratægus odoratissima*, *Acer monspessulanum*, *Juglans nigra*. Weakly: *Æsculus Hippocastanum*, *Pyrus Aria*, *Salix alba*, *Fraxinus Ornus*. I have observed seeds germinate on the following trees, but have never got beyond that stage:—*Fraxinus pubescens*, *Diospyros virginiana*, *Pyrus intermedia*, *Cerasus serotina*, *Gymnocladus canadensis*, *Ailantus glandulosa*, *Corylus Colurna*." Mr. Burbidge, who forwarded Mr. Baker's communication from Oxford, adds:—"I have never seen it growing on the Beech or Viburnum, as stated at the Committee on March 12."

Hepatica triloba alba.—Herr A. M. C. van der Elst, of the Royal Tottenham Nurseries, Dedemsvaart by Zwolle, Holland, sent flowers of this rare variety. ("They have suffered a little from the bad weather, but when fully developed they are quite as large as the double red and larger than the double blue. The original plant was found some years ago in

the Hartz Mountains.") Canon Ellacombe observed that it was known as an autumnal form of the double Hepatica.

Cattleya Deformed.—Mr. G. Cragg, gardener, Percy Lodge, Winchmore Hill, sent a remarkable form of *C. intermedia.* There were four flowers on the spike, the two lower ones being perfect. The specimen sent was one of the two upper flowers, both of which were deformed. The flower sent had two coloured sepals, situated laterally, and two lips, one posterior, the other anterior, closely folded together. Within was a column without anthers.

Preparation of Woad.—An interesting paper was sent by Dr. Plowright, with numerous specimens, showing the production of the blue colour derived from this plant. After alluding to several ancient writers, who described the colour as blue, green, and black, Dr. Plowright could find no recent information as to how the colour was extracted; as, though *Isatis tinctoria* is cultivated round Wisbech, where the manufactory still exists, it is no longer grown for the dye, but for a fermentable substance which renders true indigo (Indigofera sp.) "fast." After experimenting he found how all the colours, blues, greens, and blacks, could be obtained. (See p. 83.) Prof. Church remarked that Chinese indigo is said to be made from Woad; the "balls" of pounded leaves being extremely like those made in India from the species of Indigofera. He observed, also, that different qualities occur at different stages of growth. He added that the colouring matter is not only produced in the leaves (in the chlorophyll cells, according to Dr. Plowright), but also in the seeds. These contain two colouring matters, the true indigo and erythrophyll, the ordinary red colour of flowers, &c. The ripe fruits of the Woad plant sent by Dr. Plowright were deeply stained naturally of a dark violet colour.

SCIENTIFIC COMMITTEE, MAY 7, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and twenty members present.

Beetroot Tumour.—Dr. M. C. Cooke reported as follows upon specimens sent to recent meetings:—"The tumour on the Beet is a somewhat globose nodule on the side of the root, about the size and form of a Tangerine Orange, attached to the root by a narrow neck, scarcely an inch in diameter. When the root was cut down the substance of the tumour did not seem to differ from that of the root; the pale zones on the side next the swelling passed into the tumour, traversed it concentrically, with something of the appearance which a transverse section of the root would exhibit. At the periphery darker spots appeared, just below the surface, which were nearly black, and mostly with a small central cavity. The walls of this cavity and the blackened part generally were traversed by a delicate network of mycelium, but I could find no trace of spores, or conidia, or fruit of any kind in the cavities. I may add that externally the tumour showed no discoloration or other evidence of the concealed blackened spots. The reference which was on my mind when I first saw the root was a short note in Massee's 'Plant Diseases' (p. 225), in which he calls it 'Beetroot tumour,' and says that it occurred in the grounds of the School of Agriculture, near Algiers, and before

that time it was unknown. This must have been about seven years ago. It is thus described: 'Large nodules of brain-like outgrowths develop near the apex of the root, and may consist of modified leaves or rootlets; the tumours are fleshy, attached to the root by a short narrow neck, and in the substance are numerous cavities filled with dark-coloured spores. The spores are subglobose, produced at the apex of a hypha, which bears a large vesicular swelling just below the spore.' It can only be added that the name given to the fungus causing the tumour is that of *Œdomyces leproides*. Its relations are to a certain degree with the Ustilagines, or smuts, but require further investigation. It is impossible in the absence of fruit of any kind to affirm that the tumour under notice is the same as the Algerian specimens, although it seems probable. The production of spores may have been arrested by the climatic conditions, which are so different from what they would be in North Africa. The blackened spots and the plentiful mycelium would indicate the work of a

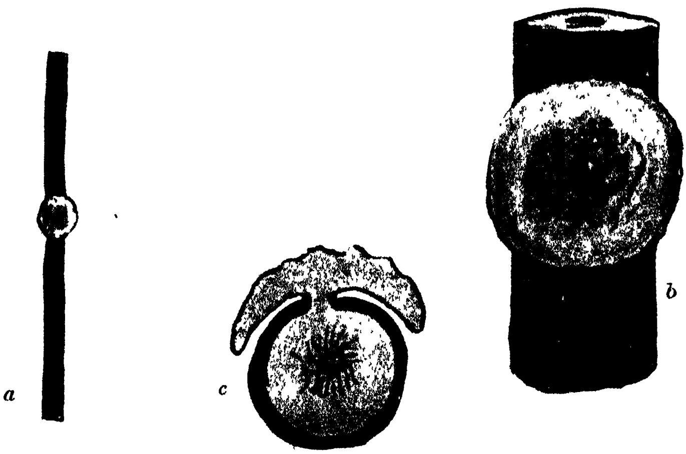


FIG. 122.—GALLS ON SCHINUS MOLLE.

a, NATURAL SIZE; *b*, ENLARGED FIVE TIMES; *c*, SECTION THROUGH GALL AND BRANCH.

fungus pest. An opportunity presenting itself, I submitted the affected Beetroot to Mr. Massee, and he was equally interested with myself in its examination, and together we consulted the authorities who had written on the subject, coming to the conclusion that it was very probable that our tumour was the same as the Algerian one, but only in its initial stage, assuming that it required a higher temperature for its full development. His microscopical examination confirmed my own, that there was a profuse mycelium present, and that doubtless the tumour was the result of fungal parasitism."

Galls on Schinus molle.—Dr. Cooke also reported on the young twigs and green leaves of *Schinus molle*:—"The leaves proved to be perfectly sound and healthy, but attached to the twigs we found five or six small discoid fleshy bodies, about two millimetres in diameter, attached, like a button, by a small central shank. These excrescences were whitish at the circumference, roseate, and rather corrugated towards the centre. In

substance they were soft and fleshy, easily cut with a penknife, and apparently solid. Under the microscope the cell structure was found to be that of the host-plant, and there were no traces of mycelium. All the evidence seemed to indicate that these bodies were a kind of gall produced by the plant in consequence of some such irritation as that caused by the puncture of an insect. Unfortunately we could find no trace of egg, larva, or insect; but it is in that direction we believe further investigation should be directed, and the plant should be watched for further developments. In both instances, therefore, we were only partially successful, and shall at any time be glad to examine either in a more advanced stage, when doubtless we shall have to relegate the latter to the entomologist." (Fig. 122.)

Daffodils, Monstrous.—Rev. W. Wilks showed a specimen of what ought to have been a large trumpet Daffodil, but the peduncle bore two flowers of nearly the ordinary size of the wild Daffodil, instead of a single and large blossom. There was no fasciation. It was interesting as a reversion to the form and size of the wild Daffodil, in consequence of there being two flowers in place of one. Mr. W. Logan, of Hither Green, Lewisham, sent specimens which had the corona split up into segments, and more or less crested. One-half of the trumpet was elongated, the other half abbreviated, possibly indicating a double parentage of *N. poeticus* crossed with the Daffodil. In another case the leaf was sheathed, as occurs in grasses; the flower had five perianth leaves, five stamens, and two carpels, due to a partial arrest of growth on one side of the flower.

Ferns, Crested.—Mr. Druery remarked that in the discussion on fasciation on April 9 he feared he did not make himself quite clear, as he certainly did not wish to imply any correlation between extra division, *e.g.* tripinnation and cresting; he intended to cite cases in which the two things were associated, every terminal major or minor even to the fourth or quadrupinnate degree of division assuming that fissile character known as cresting. He added that there is this difference between cresting and fasciation. In the latter, as the term itself implies, the multiplied apices of growth keep together and build up a more or less solid structure, with little or no tendency to separate or ramify independently; in the former, on the other hand, the tendency, he thought he might say, invariably is to ramify again and again as speedily as possible after the multiple apices of growth are generated. Clearly, then, although both abnormalities spring from a like tendency in the normally single apical cells to split up into several or many, they are essentially different in their ultimate developments, and the word fasciation can only properly apply to one of them. He also pointed out that in fasciated plants, *e.g.* the Lilies, when the leaves or flowers are formed, there is no tendency to form multifid tips to them or their component parts, whereas in ferns this is always seen according to the degree in which the general tendency presents itself. Prof. Henslow observed that Mr. Druery was perfectly correct. The term "fasciation" was only applied by Linnæus to stems; but as it is correlated with a continual branching of the fibro-vascular cords, he classed it with several other phenomena of foliar organs, which are associated with a similar repeated chorisis of the cords, as *e.g.* in crested

sepals of the Rose, the petals of Cyclamen, &c.; and Mr. Druery added the crested apices of Ferns, in none of which is there any necessary fasciation whatever. Dr. Masters criticised Prof. Henslow's statement, which laid stress on the development of the fibro-vascular cords, as the cellular growing points precede the formation of vessels. But this was a necessary feature, as the fibro-vascular cords could not exist unless they were clothed with parenchyma. As, however, their several branches ultimately entered the foliar organs of a multifold flower, Prof. Henslow did not think the criticism had weight. In fact, the development of cellular tissue and cords goes on simultaneously, the former continually providing the material through which the cords may ramify, and often outstripping them, as in the margins of crested petals, into which the cords do not travel far enough to reach the actual margin itself.

Violets, Self-fertilising.—Mr. W. J. James, Woodside, Farnham Royal, Slough, sent some white Violets (*Viola odorata*) which produced seed capsules. As a rule the purple Violet sets no seed in this country, though it does in S. Europe. On examination it was found that the flowers became self-fertilising, because the beak-like extremity of the style with its stigmatic orifice was not only strongly curved upwards (because the flower is inverted), instead of being at right angles with the style, but was completely included within the connivent connectives. The connectives were all wrapped round the style, preventing the escape of the pollen, which is then caught by the spoon-like two lowermost connectives. The pollen falls directly on to the stigmatic orifice. The flower is thus perfectly adapted to secure self-fertilisation. The plants are also provided with the usual cleistogamous buds. In these there are five minute petals, five anthers all alike without tails, forming a star-like group upon the summit of the ovary. The stigma is short, truncated, and concealed beneath the anthers, the pollen of which enters the stigma without the anthers dehiscing by the tubes penetrating them along the lines of dehiscence in normal anthers. Prof. Henslow showed plants of the N. American species, *V. cucullata*, &c., with cleistogamous buds, apparently indicating the fact that these had become a specific character before a world-wide diffusion of the germs had taken place.

"*Kent*" *Water Unsuitable for Plants.*—Mr. E. Roberts, Park Lodge, Eltham, writes as follows: "Our water from the Kent Waterworks is not at all a fit food for our plants. I am in the habit of treating it thus. I first add 1 lb. caustic lime to 1,000 gallons to neutralise the calcium carbonate, and then add 6 oz. amm. sulph., 6 oz. potassic nitrate, and 4 oz. amm. phosph. I shall be glad to know if this treatment can be improved upon, and if it is suitable for Orchids generally, including epiphytal." Prof. A. H. Church, who undertook to examine the water, reports as follows: "In reference to Mr. Roberts's letter, I should like to make a few remarks. I have looked up the older analyses of this water, because the official results do not now include determinations of sulphates and of calcium in its several salts. After adding the caustic lime (preferably after slaking, and in the form of cream), the whole bulk of treated water is (I presume) allowed to rest, that it may deposit the separated carbonate of lime. Then to the clear liquid the salts named should be added. I think the quantities named reasonable. Anyhow, the prepared

water is a mild stimulant and general plant food. Owing to the partial removal of the lime salts, it ought not to spot the foliage with a white deposit. I should not like to say anything as to its peculiar suitability to Orchids, terrestrial or epiphytic, but I think its use cannot be injurious."

Odontoglossum crispum, peloric.—Mr. T. Rochford sent a specimen in which the lateral petals were more or less crested and spotted like the lip.

Gloxinias.—Specimens with internal paracorolla and external linear crests were exhibited by Mr. Houston.

Hymenocallis sulphurea.—Mr. Worsdell showed this plant, being the same as one of Dean Herbert's hybrids.

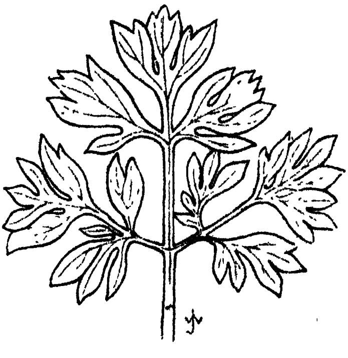
Seedling Lilies growing underground.—Mr. Worsdell referred to this subject, and added remarks upon the germination of certain monocotyledons without a cotyledon. Mr. Elwes said that he had observed how seeds of *Daphne Mezereum* and Lily seeds remained a long while in the ground —even three years—and then germinated. *Cephalanthera rubra*, he observed, was said to have germinated after some seventy years. Rev. C. Wolley-Dod remarked, with reference to this subject :—"In my garden the seed of Lilies often germinated, and the bulbs grew for three or four years without any visible growth above ground. This statement has been very fairly questioned, and it was said that it could not be admitted as a fact of vegetable physiology without minute and particular details. I confess that I have never made careful and continuous observations in the matter, chiefly because I assumed that it was generally known and admitted. The particular Lily about which my impressions are very strong is *L. monadelphum.* This species thrives particularly well in the heavy, retentive soil of my garden. I have been in the habit at any time during the last twenty-five years of taking a handful of the seed of this when ripe and throwing it on the surface and raking it in where there were two or three square yards of untenanted soil. At first I used to suppose that the seed perished, as no growth appeared above ground; but on digging at the end of a year or two, bulbs were found from the size of a Pea to that of a Hazel-nut, but it was not till the third or fourth year that above-ground growth, nearly ready to flower, or perhaps with one flower-bud, appeared. The bulbs had not only increased in size, but had dived several inches beneath the surface. As it appears that this habit is doubted by competent botanists, it would be well to have it settled by some observer more likely to see the experiment through than I am, and I shall have much pleasure, next August, in distributing packets of seed to any amateurs who will make the trial, and at the end of four years announce the result of their observations." Some years ago the question came before the Scientific Committee as to the possibility of fully developed bulbs increasing in size below the soil without having any external stem or foliage. It was maintained by some growers that such was really the case.

Hybrid Carnations.—From Mr. Percy D. Williams, of Lanarth, Cornwall, came flowers of 'Lady Buxton' Carnation × Sweet William ♂; also the latter × 'Uriah Pike' (crimson) Carnation; also 'Duchess of Fife' (rose) × Sweet William. They were very intermediate in character, with no scent, but having more of the Sweet William foliage, and with flowers showing a tendency to cluster. (See fig. 135.)

Cattleya Lawrenceana, Malformed.—Mr. O'Brien showed a flower devoid of a labellum, also *C. Mendeli*, which often comes deformed, and more or less constantly so in plants from certain areas. Mr. Douglas observed that he had a plant with fifteen flowers, dimerous, or lipless, &c.

Crinum sp.—Mr. Elwes exhibited plants of Crinum which flowered after fifteen years. They came from near Lake Nyassa, and there was a doubt as to their specific differences from *C. capense*, as there was great variability among plants from seeds. *C. crassifolium* (according to Dutch growers) appeared to be the same as *C. petiolatum* from the Niger, remarkable for its globular bulb, and by continuously flowering.

Plants from Cambridge Botanic Gardens.—Mr. Lynch exhibited the following interesting plants :—*Dimorphotheca fruticosa*, only lately introduced to Cambridge from S. Africa ; *Lathræa clandestina*, with large purple flowers, which Mr. Lynch has succeeded in establishing on the roots of Willows, as well as our native *L. squamaria* on Poplars ; *Hippeastrum aulicum*, one of the species of the original hybrids of the modern so-called Amaryllis, remarkable for the great obliquity of the perianth leaves ; *Cheiranthus mutabilis*, the true plant, and not the same as that usually grown under this name ; it is not quite hardy. Prof. Church remarked that specimens grown at Kew show a larger range of colours than those of the Cambridge plants, and that the peculiar nature of the colouring matters is due to changes in the neutrality, alkalinity, or acidity of the sap. *Acer carpinifolium.*—This is one of the several Japanese species, having leaves without lobes, the blade closely resembling that of the Hornbeam. *Helwingia japonica.*—The foliage is remarkable for having the peduncles adherent to the petiole (as is that of the Lime to the bract), so that they are apparently borne by the leaf, and resemble superficially *Ruscus aculeatus*. *Citrus trifoliata*, a very spinescent species, requires only a very slight protection. Dr. Masters observed that it was used in Florida as a stock for Oranges, so that they could withstand frost. *Hymenanthera crassifolia*, a shrub both in flower and fruit of the family Violaceæ. It is a native of New Zealand. *Hibbertia scandens*, perhaps the largest flowering species, somewhat resembling *Hypericum calycinum*, while *H. Readi* bore the smallest flowers ; probably natives of Australia. *Stigmaphyllon ciliatum*, a handsome, yellow-flowered Malpighiad. *Macleania insignis*, of the order Vacciniaceæ, a very uncommon plant, figured from the Cambridge plant in *Bot. Mag.* t. 7694 (1900).



FRUIT AND VEGETABLE COMMITTEE.

JANUARY 15, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twenty members present.

Awards Recommended:—

First-class Certificate.

To Pear 'Joséphine de Malines' (votes, unanimous), from Messrs. J. Veitch, Chelsea. This fine flavoured and prolific variety is well known as the best mid-winter Pear after 'Winter Nelis' is over, succeeding well

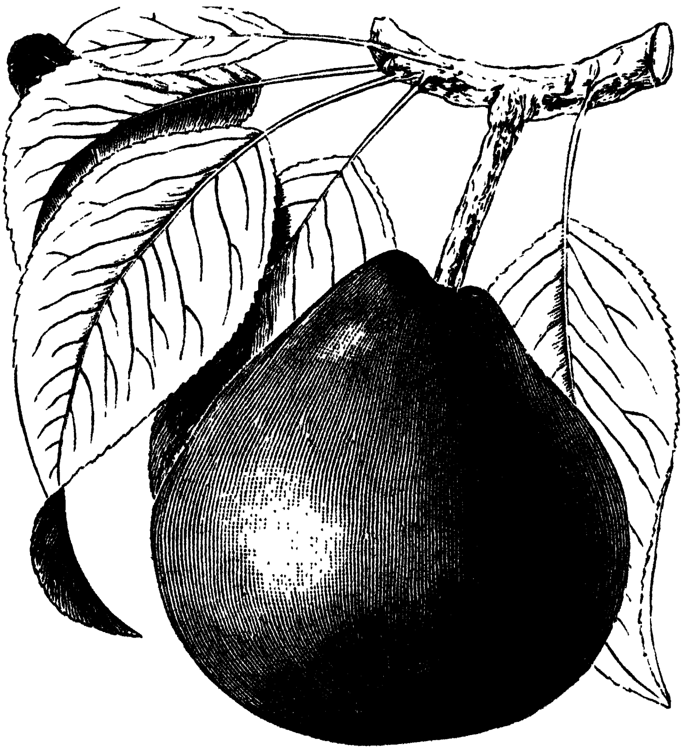


FIG. 123.—PEAR 'JOSÉPHINE DE MALINES.' (*Journal of Horticulture.*)

in almost any sort of soil, of hardy constitution, and equally fruitful on the Pear or Quince stock, in bush form or on a wall. (Fig. 123.)

Cultural Commendation.

To Mr. Alfred Kay, 16 Barrowgate Road, Chiswick, for a very fine dish of 'Catillac' Pears, one of the best stewing varieties.

Other Exhibits.

Messrs. J. Veitch sent the following varieties of Pears, viz. 'Olivier de Serres,' 'Easter Beurré,' 'Bergamotte Esperen,' 'Nec Plus Meuris,'

'Beurré Rance,' and 'St. Germains,' the last-named being flavourless, and scarcely worth growing. All had been grown on pyramid trees in open quarters.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon), sent fine specimens of Pear 'Beurré Rance' from old standard trees grown in London.

FRUIT AND VEGETABLE COMMITTEE, JANUARY 29, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and seventeen members present.

Awards Recommended:—

Silver Knightian Medal.

To Messrs. Cannell, Swanley, for sixty dishes of Apples.

Award of Merit.

To Apple 'Reinette de Canada' (votes, 7 for, 6 against), from W. H. Long, Esq., Rood Ashton, Trowbridge (gr. Mr. Strugnell). Fruit above

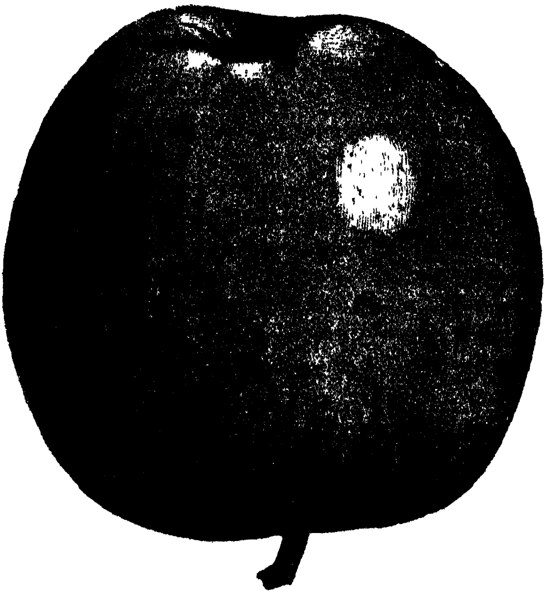


FIG. 124.—APPLE 'CLAYGATE PEARMAIN.' (*Journal of Horticulture.*)

medium size, conical, with large ribs near the eye; skin greenish-yellow, and covered with russety spots; eye usually half open, set in a deep puckered basin; stalk one inch long, thin, and set in a deep cavity; flesh white, crisp, juicy, and of good flavour. A very good late dessert Apple. The tree is a strong grower, and bears freely with age. A fairly well known variety.

To Apple 'Claygate Pearmain' (votes, unanimous), from W. H. Long, Esq. Fruit of medium size, rather conical, smooth; skin yellow and nearly covered with russet, occasionally flushed and striped with red on the exposed side; eye large and open, with long segments, set in a

moderately deep basin; stalk one inch long, thin, and inserted in a deep cavity; flesh very crisp, and of excellent flavour for a late Dessert Apple. This variety is also known as 'Ribston Pearmain' in the West of England, probably from its similarity to 'Ribston Pippin' in flavour. (Fig. 124.)

To Apple 'Brabant Bellefleur' (votes, 10 for), from Lord Poltimore, Exeter (gr. Mr. T. H. Slade). Fruit large, broader than it is long; skin yellow on the shaded size, brilliant red on the exposed side; eye large and open, with large segments, set in a wide, deep basin; stalk short and set in a deep cavity; flesh white and crisp; an old cooking variety of excellent quality. The tree is hardy, vigorous, and a good bearer. (Fig. 125.)

To Apple 'Beauty of Kent' (votes, unanimous), from Roger Leigh, Esq., Barham Court, Maidstone (gr. Mr. G. Woodward). Fruit very large,

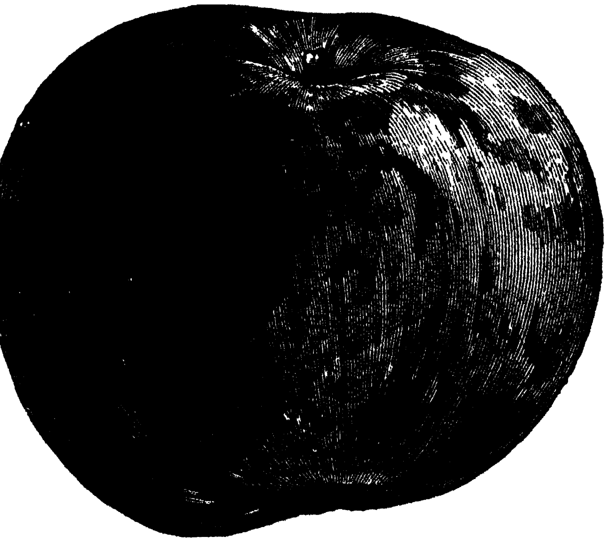


FIG. 125.—APPLE 'BRABANT BELLEFLEUR.' (*Gardeners' Chronicle.*)

round, terminating at the apex in ridges; skin yellow, heavily marked and striped with red on the exposed side; eye small, and tightly closed; stalk, three-quarters of an inch long and deeply inserted; flesh white, and of excellent quality when cooked. The tree is a free bearer, and of good constitution; a well-known and popular variety.

Cultural Commendation.

To Mr. G. Woodward, Barham Court Gardens, Maidstone, for three very fine dishes of 'Beauty of Kent' Apples, grown on bush trees that had not been stopped or summer pruned, the trees bearing exceptionally heavy crops.

To Mr. J. Taylor (gr. to F. Bibby, Esq., Hardwicke Grange, Shrewsbury), for a splendid dish of Pears 'Olivier de Serres.' (Fig. 126.)

To Messrs. Cannell, for a collection of very large Onions, well kept.

To Mr. J. Butler (gr. to the Earl of Ancaster), for exceedingly well grown stalks of Rhubarb 'The Sutton.'

Other Exhibits.

Messrs. Sutton, Reading, sent a new Rhubarb 'Sutton's Christmas,' respecting which they wrote as follows, viz.:—

"The stock of this Rhubarb reached us in 1894 from a correspondent in Australia, who wrote saying that it always started into growth when other Rhubarbs went to rest for the winter. He did not know whether this peculiarity would be maintained in the Old Country, but should be glad to send us roots. Since 1894 we have grown this Rhubarb, and every year it has started into growth about November, and *when not cut down by frost* has been in full vigour of growth at Christmas. Five weeks ago the plants, which were growing without any protection whatever, were in full bearing, and large bundles were pulled, averaging two

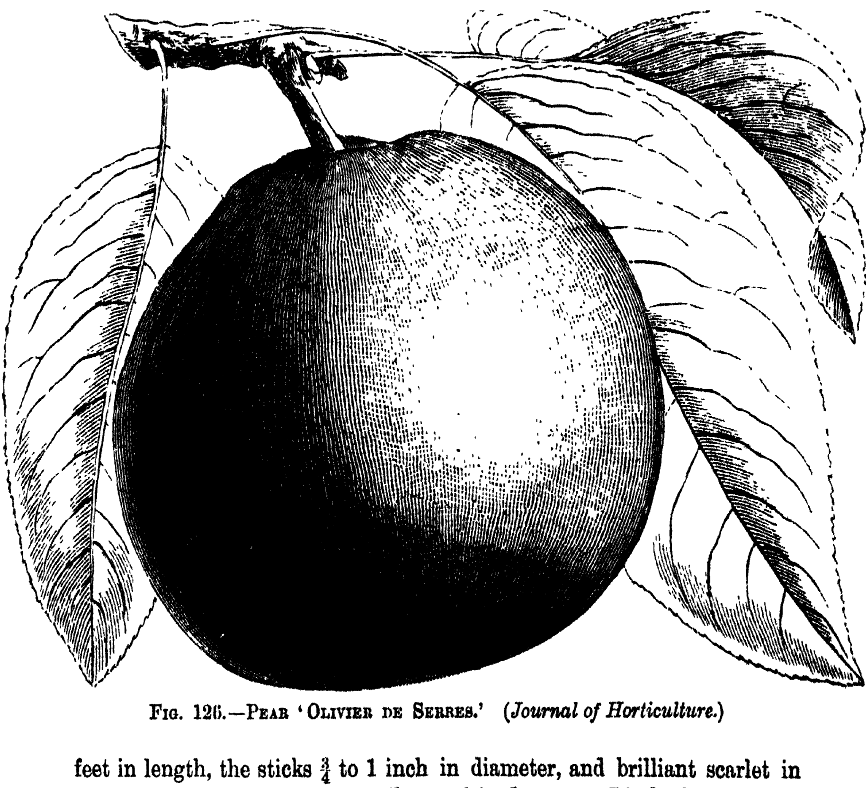


FIG. 126.—PEAR 'OLIVIER DE SERRES.' (*Journal of Horticulture.*)

feet in length, the sticks ¾ to 1 inch in diameter, and brilliant scarlet in colour. When cooked it was fully equal in flavour to Rhubarb when first ready for pulling in the spring. When the snow and frost set in abou four weeks ago, by an error of judgment on the part of the foreman, the plants were not only protected with thatched hurdles around the bed, but loose dung from the stable was piled up round the outside of the hurdles, and thatched hurdles were also placed across the top. As a result the plants were useless for submitting to the Committee, not having been really grown in the open air. About January 5 the dung was all removed, as well as the thatched hurdles on the top of the bed, in the hope that the leaves might recover their natural colour before the meeting of the Committee on the 15th inst. But on the night of the 14th we had a

severe frost, which completely destroyed the entire crop above ground. A specimen bundle was sent up on the 15th, however, but it was so much injured by the frost that it was not submitted to the Committee. The bundle now submitted has been pulled to-day from the same bed, and is entirely the growth of the last fortnight, during which time no protection whatever has been afforded to the plants, with the exception of the thatched hurdles round the outside of the bed, the top being quite open. The sticks, of course, are very small indeed—scarcely a quarter the size of those pulled five weeks ago—but as the crop has been twice cut down by frost, and this is the third growth made this winter, some evidence is afforded of the abnormal precocity of the variety."

The Committee desired that it be sent to Chiswick for trial.

Captain Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent Apples 'Edgar' and 'Bertha,' both raised from 'Cornish Aromatic' × 'Cox's Orange Pippin.'

Mr. W. Strugnell, Rood Ashton, sent Apple 'Mannington's Pearmain,' in good condition.

Mr. M. Nicholls, Tolgus Hill, Redruth, sent Apples 'Pennington Seedling' and 'Tolgus Wonder.'

Captain Cox, Beckford Hall, Tewkesbury (gr. Mr. G. Farmer), sent an Apple named 'Beckford Beauty,' which proved to be 'Barnack Beauty.'

Miss Breton, Forest End, Sandhurst (gr. Mr. R. Handley), sent some magnificent specimens of Yams (*Dioscorea Batata*).

FRUIT AND VEGETABLE COMMITTEE, FEBRUARY 12, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and eighteen members present.

Awards Recommended:—

Gold Medal.

To Messrs. Bunyard, Maidstone, for 100 magnificent dishes of Apples.

Silver Knightian Medal.

To Messrs. Cheal, Crawley, for 100 dishes of Apples.

Cultural Commendation.

To Mr. G. Wythes, V.M.H., gr. to the Duke of Northumberland, Syon House, for a well-fruited plant of *Vanilla planifolia*.

Other Exhibits.

Messrs. Brown, Peterborough, staged six pretty dishes of Apple 'Barnack Beauty.'

Mr. R. Maher, Yattenden Court Gardens, Newbury, sent Apples 'Court Pendu Plat' and 'Dutch Mignonne.'

Mr. J. Basham, Fairoak, Newport, Mon., sent a dish of Walnuts with holes at the points of the nuts. It was suggested that it was the work of rooks; but they were sent to the Scientific Committee for examination.

W. Roupell, Esq., Harvey Lodge, Roupell Park, S.W. (gr. Mr. A. Russell), sent Apples 'Cox's Orange Pippin' and 'Melon Apple.'

Rev. E. W. Jones, St. Mary's Vicarage, Spital Square, sent a dish of Apples 'Bray's Seedling,' *syn.* 'Haven Apple,' very closely resembling 'Beauty of Kent' in appearance.

FRUIT AND VEGETABLE COMMITTEE, FEBRUARY 26, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twenty-one members present.

Awards Recommended:—

Silver Banksian Medal.

To C. P. Serocold, Esq., Taplow Hall, Maidenhead (gr. Mr. R. Bullock), for a collection of Apples and Pears.

Award of Merit.

To Apple 'Diamond Jubilee' (votes, 16 for), from Mr. A. J. Thomas, Rodmersham, Sittingbourne. Fruit large and of good shape; skin yellow and slightly flushed with red on the exposed side; eye large and half closed, set in a rather deep basin; stalk short and fleshy, often obliquely inserted almost on a level with the base of the fruit; flesh white and of good quality for cooking. This variety was raised from a pip of an Australian Apple. The tree is stated to be a good bearer and vigorous grower; the fruit is said to keep sound until Whitsuntide. (Fig. 127.)

To Apple 'Scarlet Nonpareil' (votes, 12 for), from Mr. W. Crump, V.M.H., Madresfield Court, Malvern. A first-rate dessert Apple in use during the early months of the year, and a well-known variety raised nearly a hundred years ago.

Cultural Commendation.

To Mr. J. Miller, gr. to Lord Foley, Ruxley Lodge, Esher, for a very fine basket of Mushrooms.

Other Exhibits.

E. W. Caddick, Esq., Caradoc, Ross (gr. Mr. M. Roe), sent Apple 'Caradoc Scarlet.' A very handsome fruit, but not considered first rate in quality.

Mr. J. Basham, Fairoak Nurseries, Bassaleg, Newport, Mon., sent an unnamed Apple of good quality, which the Committee desired to see again when named.

Mr. A. J. Jackson, 22 Somerset Terrace, St. Pancras, staged samples of Garden Hose. The Committee wished them to be tried at Chiswick.

Captain Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent Pear 'Earl Roberts,' raised from 'Joséphine de Malines' × 'Bonne d'Ezée.' Fruit large and of pyriform shape, but gritty in the flesh.

W. Bryant, Esq., Stoke Park, Slough (gr. Mr. D. Kemp), sent Apple 'Lewis's Incomparable.'

Messrs. Yarde, 10 Market Square, Northampton, sent Apple 'King Edward.' A small yellow fruit.

Mr. T. Clinch, Denaway Key Street, Sittingbourne, sent Apple 'King

Edward,' quite distinct from the above; raised from 'Worcester Pearmain' × 'Northern Greening,' and most resembling the latter parent.

Messrs. Bunyard, Maidstone, sent Pear 'Verulam,' *syns.* 'Black Pear of Worcester,' 'Black Jack,' and 'Spring Beurré.' The fruit was very good, and quite fit for dessert—a condition which occurs perhaps twice

FIG. 127.—APPLE 'DIAMOND JUBILEE.' (*The Garden.*)

in a century, proving what a very exceptional season 1900 had been for late Pears.

Earl Beauchamp, Madresfield Court, Malvern (gr. Mr. W. Crump, V.M.H.), sent a small collection of well-kept Apples from a cool chamber below the ground level. Mr. Bunyard stated that he found the secret of

keeping Apples perfectly sound was to have a fruit room with an ordinary earth floor—not boarded or tiled—and to occasionally sprinkle the floor with water to give atmospheric moisture even in winter, the majority of fruit rooms being much too dry for keeping fruit sound.

Rev. W. Wilks, M.A., Shirley Vicarage, Croydon, sent a basket of highly coloured and well-preserved fruits of Apple 'Cox's Orange Pippin.'

FRUIT AND VEGETABLE COMMITTEE, MARCH 12, 1901.

Mr. GEORGE BUNYARD, V.M.H., in the Chair, and twenty-three members present.

Awards Recommended :—

Gold Medal.

To Messrs. J. Veitch, Chelsea, for 100 dishes of splendid Apples.

Silver Knightian Medal.

To Mr. A. J. Thomas, Rodmersham, Sittingbourne, for 60 dishes of Apples.

Award of Merit.

To Apple 'Lamb Abbey Pearmain' (votes, 11 for, 7 against), from Messrs. J. Veitch. Fruit small, deep, round, handsome shape ; skin pale green changing to yellow, with a slight flush of red on the exposed side, marked all over with minute russety dots; eye of medium size and partly open, with broad segments, set in a moderately wide basin; stalk half-inch long, thin, and deeply inserted in a russety cavity; flesh firm, brisk, and of excellent flavour. A very small and old variety, raised in 1804 ; it keeps sound until May.

Other Exhibits.

Mr. E. B. Chambers, 32 Broad Street, Abingdon, sent Apple 'Joe Eaton,' raised from pips of 'Blenheim Orange,' and not so good as its parent.

E. W. Caddick, Esq., Caradoc, Ross (gr. Mr. M. Roe), sent Apple 'Caradoc Scarlet.'

Mr. R. Maher, Yattenden Court Gardens, Newbury, sent three dishes of Apples.

Mrs. Ernest Hill, Redleaf, Penshurst (gr. Mr. G. Ringham), sent ten dishes of Apples.

FRUIT AND VEGETABLE COMMITTEE, MARCH 26, 1901.

Mr. GEORGE BUNYARD, V.M.H., in the Chair, and nineteen members present.

Award Recommended :—

Cultural Commendation.

To Mr. C. Dixon, gr. to the Earl of Ilchester, Holland House,

Kensington, for excellent 'Easter Beurré Pears' grown on standard trees in London.

Other Exhibits.

Mr. J. Watkins, Pomona Farm, Withington, Hereford, sent Apple 'Litamien Pippin,' or 'Milk Apple,' a very pretty fruit with soft white flesh. Mr. Watkins stated that he received the grafts from Russia, the trees therefrom bearing very heavy crops of fruit.

Mr. H. Kempshall, Lamport Hall Gardens, Northampton, sent a seedling Apple very similar to 'Blenheim Orange,' but not so good in flavour.

FRUIT AND VEGETABLE COMMITTEE, APRIL 9, 1901.

Mr. GEORGE BUNYARD, V.M.H., in the Chair, and thirteen members present.

Award Recommended:—

Bronze Banksian Medal.

To Mrs. Nix, Tilgate, Crawley (gr. Mr. E. Neal), for 29 dishes of Apples.

Other Exhibits.

The Earl of Ilchester, Holland House, Kensington, W. (gr. Mr. C. Dixon), sent Pear 'Bergamotte Esperen' in very good condition for this uncertain variety. He also sent Apple 'Cluster Golden Pippin' from a tree 150 years old, the fruit being of good size and nice colour.

FRUIT AND VEGETABLE COMMITTEE, APRIL 23, 1901.

Mr. GEORGE BUNYARD, V.M.H., in the Chair, and twenty-four members present.

Award Recommended:—

Cultural Commendation.

To Mr. G. Woodward, gr. to R. Leigh, Esq., Barham Court, Maidstone, for a very fine dish of Apple 'Calville Malingre' (Malingre d'Angleterre). This is an excellent cooking variety of fine colour, and the tree is a vigorous grower and free bearer in the South and West of England.

Other Exhibits.

Messrs. Laxton, Bedford, sent Rhubarb 'Laxton's Scarlet,' from 'Hawke's Champagne' × 'Royal Albert.' Stalks long, deep red, and when cooked of fine colour. The Committee requested that the variety be sent to Chiswick for trial.

Messrs. Cheal, Crawley, sent a small collection of dessert Apples, the best being 'Brownlee's Russet,' 'Boston Russet,' and 'Allen's Everlasting.'

Mr. W. Palmer, Andover, sent Apples 'Lord Kitchener' and 'Wellington,' the former very similar to the latter well-known variety.

FRUIT AND VEGETABLE COMMITTEE, MAY 7, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twenty-one members present.

Awards Recommended:—

Silver-gilt Knightian Medal.

To Messrs. Jas. Veitch, Chelsea, for 80 dishes of Apples.

Cultural Commendation.

To Mr. B. Greaves, gr. to A. Hargreaves-Brown, Esq., M.P., Broome Hall, Holmwood, Surrey, for a box of fine 'Royal Sovereign' Strawberries.

To Mr. J. Downes, gr. to J. T. Bennett-Poë, Esq., Holmwood, Cheshunt, for a dish of beautiful Lemons.

To Messrs. Cannell, Swanley, for six boxes of Pea 'King Edward VII.'

Other Exhibits.

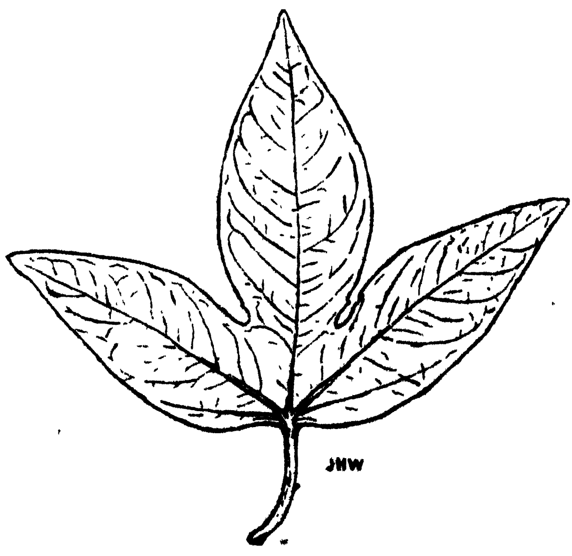
From the Society's Gardens came a collection of Radishes grown for the Salad trial from seeds sent by Messrs. Carter, Barr, R. Veitch, and J. Veitch.

Messrs. Laxton, Bedford, sent Apple 'Countess Cowper.' Fruit of medium size, round; eye half closed; stalk very short and deeply inserted; skin bright scarlet on exposed side, yellow on the shaded side; flesh crisp and of fairly good flavour.

Mr. F. Cowley, Beaumont Manor Gardens, Wormley, Herts, sent Apple 'Phipps' Wonder.' Very similar to 'Reinette de Canada' in appearance, but not so good as that variety.

Mr. F. H. Kettle, King's Ford, Colchester, sent Apple 'Stainway Seedling.'

Percival Bosanquet, Esq., Pondfield, Hertford, sent fruits of a large pear-shaped navel Lemon, a variety received from California. The fruits had a very thick rind, and the flesh was almost bitter in taste.



FLORAL COMMITTEE.

JANUARY 15, 1901.

Mr. W. MARSHALL in the Chair, and eighteen members present.

Awards Recommended:—

Silver Flora Medal.

To Mr. J. Russell, Kew Road, Richmond, for a large group of Aucubas carrying an abundance of bright scarlet berries.

Award of Merit.

To Primula floribunda grandiflora isabellina (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). A profuse blossomer, differing from the type by reason of its charming sulphur-yellow flowers borne in larger whorls on tall stout spikes. It is a continuous bloomer and comes true from seed.

To Cyclamen libanoticum (votes, 12 for), from Messrs. Jackman, Woking. A new hardy dwarf species, with marbled leaves and small dainty slightly fragrant rose-pink flowers, passing to a lighter shade near the purplish-crimson base.

Other Exhibits.

Rev. W. Goodliffe, Northcourt Road, Worthing, sent two unnamed Pelargoniums from Central Africa.

Mrs. Campion, Reigate (gr. Mr. J. Fitt), sent flowers of Manettia bicolor and Narcissus Bulbocodium.

Mr. Godfrey, Exmouth, sent flowers of Decorative Chrysanthemum 'Winter Queen.'

Messrs. Jas. Veitch, Chelsea, sent a small group of Coleus thyrsoideus, a new winter-flowering species with rich blue flowers.

Messrs. Jackman, Woking, sent a group of hardy flowering plants.

Messrs. Barr, Covent Garden, sent forced bulbous plants.

Messrs. Wallace, Colchester, sent Irises.

Messrs. Sinclair, Finsbury, sent Triplex garden syringes and diffusers.

Mr. C. J. Wakefield, Hindon Street, S.W., sent a patent flower support.

FLORAL COMMITTEE, JANUARY 29, 1901.

Mr. W. MARSHALL in the Chair, and fifteen members present.

Awards Recommended:—

Silver Banksian Medal.

To F. D. Lambert, Esq., J.P., Moor Hall, Cookham, Maidenhead (gr. Mr. J. Fulford), for Cyclamen.

To Mr. John R. Box, West Wickham, for Primulas.

To Messrs. Cannell, Swanley, for Primulas.

To Messrs. Ware, Feltham, for Alpines and hardy flowers.

Award of Merit.

To Rhododendron 'King Edward VII.' (R. Teysmanni ♂, R. javanicum ♀) (votes, 9 for, 1 against), from Messrs. Jas. Veitch, Chelsea. The plant is vigorous, of good growth, and abundant in blossom. The flower trusses are large, deep yellow in colour, similar but superior to R. 'Exquisite.'

Other Exhibits.

W. Nicholson, Esq., Basing Park, Alton (gr. Mr. W. Smythe), sent flowers and buds of a new hybrid Passiflora named 'Basing Park hybrid,' the result of crossing P. racemosa ♀ with Tacsonia exoniensis ♂. The Committee asked to see this again.

Messrs. Jas. Veitch, Chelsea, sent very beautiful plants of Coleus thyrsoideus which had been in flower quite six weeks.

Mr. John Russell, Richmond, sent Cupressus Lawsoniana erecta aurea, a neat-growing conifer with foliage of a golden hue.

Messrs. Barr, Covent Garden, sent Hellebores and Hyacinths.

Messrs. Jackman, Woking, sent hardy forced flowers.

Mr. C. J. Wakefield, Hindon Street, London, sent Floral-aids.

FLORAL COMMITTEE, FEBRUARY 12, 1901.

Mr. W. MARSHALL in the Chair, and twenty-four members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Purnell Purnell, Esq., Woodlands, Streatham Hill, for Narcissi.

To Messrs. W. Paul, Waltham Cross, for Clematis indivisa and C. i. lobata.

To Messrs. Cannell, Swanley, for Primulas.

Silver-gilt Banksian Medal.

To Messrs. Hill, Lower Edmonton, for Ferns.

Silver Flora Medal.

To Messrs. Ware, Feltham, for hardy flowers.

Silver Banksian Medal.

To Messrs. Cutbush, Highgate, for Croci.

To Mr. John R. Box, West Wickham, for Primulas.

To Messrs. Williams, Upper Holloway, for forced shrubs.

Bronze Flora Medal.

To Messrs. Paul & Son, Cheshunt, for forced Lilacs.

Bronze Banksian Medal.

To Messrs. Jackman, Woking, for hardy flowers, amongst which was the new Cyclamen libanoticum. (Fig. 128.)

To Messrs. Laing, Forest Hill, for foliage and flowering plants.

Award of Merit.

To Pteris cretica albo-lineata Alexandræ (votes, 7 for, 5 against), from Mr. H. B. May, Upper Edmonton. Of more elegant habit than the type, from which it also differs by reason of the broad crestings at the tips of the fronds.

Other Exhibits.

The Director, Royal Gardens, Kew, sent a very fine specimen of

FIG. 128.—CYCLAMEN LIBANOTICUM. (*The Garden.*)

Dracontium (Godwinia) Gigas, an uncommon Aroid of the same habit as Amorphophallus.

J. C. Eno, Esq., Woodhall, Dulwich (gr. Mr. R. Leech), sent a collection of unnamed seedlings of Helleborus orientalis.

W. Nicholson, Esq., Basing Park, Alton, Hants (gr. Mr. W. Smythe), again sent flowers of the 'Basing Park hybrid' Passiflora.

From the Floral Exchange Co., Philadelphia, came flowers of Rose

'Queen of Edgely,' cut with stems 2 feet long. The foliage was quite fresh but the flowers unfortunately fell to pieces immediately they were unpacked, so that no opinion could possibly be formed upon them.

Messrs. Jas. Veitch, Chelsea, sent Rhododendrons and a small well-flowered plant of Loropetalum chinense.

Messrs. Nieuwenhuis & Zonen, Holland, sent a new Narcissus, 'King Edward VII.'

Messrs. Barr, Covent Garden, sent hardy flowers.

Messrs. Heath, Cheltenham, sent double Primulas.

Floral Committee, February 26, 1901.

Mr. W. Marshall in the Chair, and twenty-two members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Messrs. W. Paul, Waltham Cross, for Camellias.
To Messrs Cuthbert, Southgate, for forced shrubs.

Silver-gilt Banksian Medal.

To Messrs. Cutbush, Highgate, for Narcissi.

Silver Flora Medal.

To Messrs. Williams, Upper Holloway, for forced shrubs.

Silver Banksian Medal.

To Messrs. Ware, Feltham, for Alpines.
To Messrs. Cannell, Swanley, for Cyclamen and Cineraria stellata.

Bronze Flora Medal.

To Messrs. Laing, Forest Hill, for foliage and flowering plants.
To Messrs. Barr, Covent Garden, for hardy flowers.

Bronze Banksian Medal.

To Messrs. Jackman, Woking, for hardy flowers.

Award of Merit.

To Iris Tubergeniana (votes, unanimous), from Miss Willmott, V.M.H., Warley Place, Essex. A new and quite distinct dainty little Iris, with long, flat, recurving, sharply pointed glaucous leaves, margined with white. The flowers, borne on sturdy stems, are greenish-yellow with prominent dark markings on the falls. (Fig. 129.)

To Adonis amurensis (votes, 18 for, 2 against), from Messrs. Wallace, Colchester. A native of Manchuria, Northern China, flowering earlier than A. vernalis. It grows a foot or so high, has delicately cut rich green leaves, and bears small deep yellow flowers. It is quite hardy and should prove a splendid plant for the rock garden. (Fig. 130.)

Other Exhibits.

The Dowager Lady Williams Wynne, Llangedwyn, Oswestry (gr. Mr. G. Squibbs), sent a new Violet.

F. W. Moore, Esq., V.M.H., Glasnevin, Dublin, sent Lachenalia 'Brightness.'

From Mrs. Thornycroft, Chiswick Mall (gr. Mr. F. Mears), came a large plant in full flower of Iris germanica. This easily grown plant is far too seldom used for cool greenhouse decoration in early spring.

T. H. Archer-Hind, Esq., Coombe Fishacre House, Newton Abbot,

FIG. 129.—IRIS TUBERGENIANA. (*The Garden.*)

sent a most interesting series of hybrid and other new seedling Hellebores.

Messrs Jas. Veitch, Chelsea, sent two varieties of Cineraria polyantha. The plants were of good habit and very floriferous.

FLORAL COMMITTEE, MARCH 12, 1901.

Mr. W. MARSHALL in the Chair, and eighteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Messrs. W. Paul, Waltham Cross, for forced shrubs.

Silver-gilt Banksian Medal.

To Messrs. Cutbush, Highgate, for single Tulips.

Silver Flora Medal.

To Mr. John May, Twickenham, for Cyclamen.

Silver Banksian Medal.

To Messrs. Ware, Feltham, for Alpines and herbaceous plants.

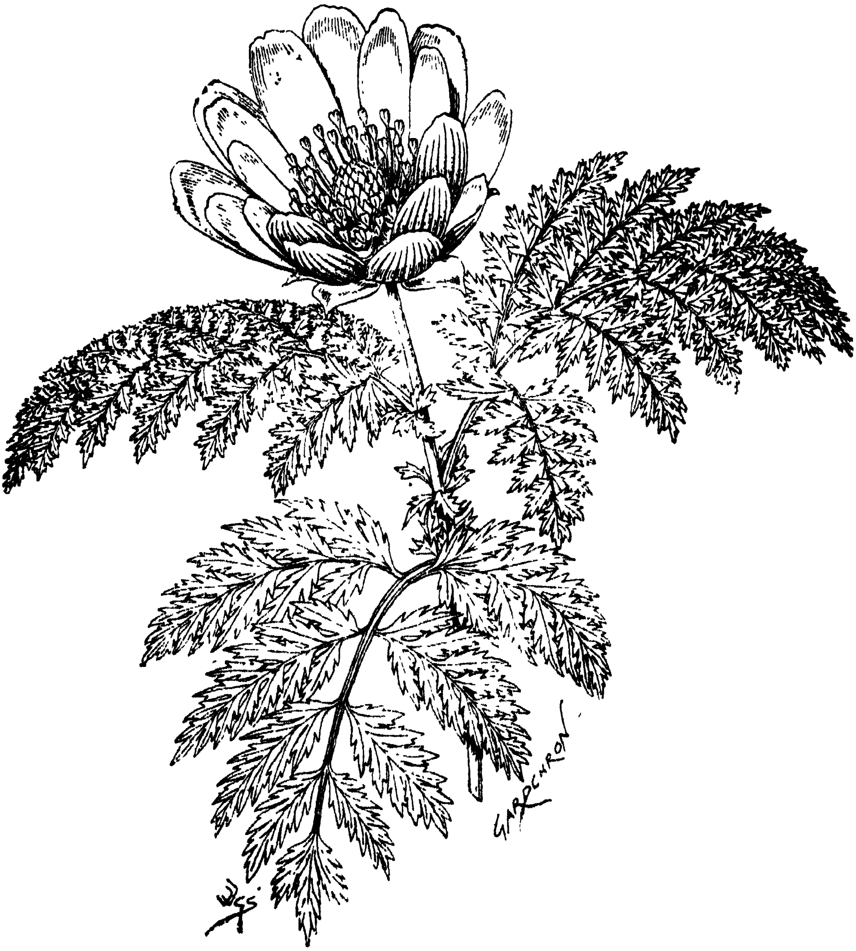


FIG. 180.—ADONIS AMURENSIS. (*Gardeners' Chronicle.*)

To Mr. Mount, Canterbury, for Roses.

To Messrs. Wallace, ~~Colchester, for hardy flowers~~, amongst which was the new species Iris Tauri. (Fig. 181.)

To Messrs. Cuthbert, Southgate, for forced shrubs.

To the Church Road Nursery, Hanwell, for Cyclamen.

Other Exhibits.

Captain Holford, C.I.E., Westonbirt, Tetbury (gr. Mr. A. Chapman), sent six seedling Hippeastrums

F. W. Moore, Esq., V.M.H., Botanic Garden, Glasnevin, sent flowers of Lachenalia 'Brilliant.'

From C. E. Shea, Esq., The Elms, Foots Cray, Kent, came three vigorous plants of Primula obconica. The flowers, borne on long stout stems, were very large, and showed a tendency towards doubling.

The Director, Royal Gardens, Kew, sent a small group of Primula Kewensis, a natural hybrid between P. floribunda ♀ and P. verticillata ♂. For description and illustration of this charming Primula see Vol. xxv. p. lxv.

Fig. 131.—Iris Tauri. (*Gardeners' Chronicle.*)

A. Chandler. Esq., Haslemere, sent two varieties of Lachenalia.

E. A. Bowles, Esq., Myddelton House, Waltham Cross, sent Chionoscilla, a hybrid between Scilla bifolia and Chionodoxa Luciliæ.

Messrs. Jas. Veitch, Chelsea, sent Cinerarias and Prunus (Amygdalus) Davidiana alba.

Mr. John Green, Dereham, sent a flowering shoot of Fuchsia 'Fireworks.'

Messrs. Peed, West Norwood, sent forced shrubs.

Messrs. Jackman, Woking, sent hardy flowers.

Messrs. Laing, Forest Hill, sent foliage and flowering plants.

Messrs. Cannell, Swanley, sent a group of Cineraria stellata, the flowers small, variously coloured, and borne in great profusion.

FLORAL COMMITTEE, MARCH 26, 1901.

Mr. W. MARSHALL in the Chair, and twenty-eight members present, with Herr Ernest H. Krelage.

Awards Recommended :—

Silver-gilt Flora Medal.

To Captain Holford, C.I.E., Westonbirt, Tetbury (gr. Mr. A. Chapman), for a grand collection of Hippeastrums.

To Mr. J. Russell, Richmond, for forced hardy flowering trees and shrubs.

FIG. 132.—NEW VIOLETS: V. SULPHUREA (TOPMOST) V. PRINCESS DE SUMENTE (BELOW). (*Journal of Horticulture.*)

Silver Flora Medal.

To St. George's Nursery, Hanwell, for Cyclamen.

To M. Lucien Linden, Brussels, for Hæmanthus.

To Messrs. Cutbush, Highgate, for Hyacinths.

To Messrs. Wallace, Colchester, for hardy bulbous flowers.

Silver Banksian Medal.

To Messrs. Jackman, Woking, for hardy flowers.

To Messrs. Jas. Veitch, Chelsea, for a group of Cineraria polyantha.

To Messrs. Cannell, Swanley, for cut flowers of Primula obconica.

To Messrs. Williams, Upper Holloway, for forced hardy flowering trees and shrubs.

Bronze Banksian Medal.

To Messrs. House, Westbury-on-Trym, for Violets. (Fig. 132.)

First-class Certificate.

To Rhododendron grande (votes, 20 for, 3 against) from F. D. Godman, Esq., F.R.S., South Lodge, Horsham (gr. Mr. Moody). A lovely Rhododendron for greenhouse decoration. It was discovered by Dr. Hooker in the Sikkim Himalaya upwards of half a century ago, and flowered for the first time in this country in 1858. It is vigorous in growth, with large rich green leaves silvery white underneath. The cream-white flowers, stained with purple at the base, are touched with rose on the exterior of the corolla in a young state. A faithful illustration is given in the *Botanical Magazine*, tab. 5054, under the name of R. argenteum.

To Hæmanthus 'Fascinator' (votes, 15 for, 5 against), from M. Lucien Linden, Brussels. A magnificent variety with a stout spike of salmon-pink flowers. The foliage is broad and deep green.

Award of Merit.

To Hæmanthus 'Queen Alexandra' (votes, unanimous), from M. Lucien Linden. The flower spike is smaller than the last-named, but the soft pink flowers are individually larger and borne in much looser trusses.

To Hæmanthus mirabilis (votes, 16 for), from M. Lucien Linden, Brussels. A large truss of salmon-coloured flowers touched with orange.

To Primula megaseæfolia (votes, unanimous), from Miss Willmott, V.M.H., Great Warley, Essex. A new species from Asia Minor and an acquisition to hardy Primroses, being very floriferous and quite distinct. It bears warm rose-purple flowers with a conspicuous yellow eye, in loose trusses on stout hairy stems 5 inches or so above the ground. Leaves cordate, hairy and deep green. (Fig. 133.)

To Lachenalia 'Kathleen Paul' (votes, unanimous), from F. W. Moore, Esq., V.M.H., Glasnevin, Dublin. A splendid variety with long rich orange-yellow flowers and bright scarlet buds. The deep green leaves are freely mottled with purple.

To Lachenalia 'Phyllis Paul' (votes, unanimous), from F. W. Moore, Esq., V.M.H., Dublin. This may perhaps be best described as an improvement on the well-known L. Nelsoni.

To Hippeastrum 'Lord Boringdon' (votes, unanimous), from Captain Holford, C.I.E., Westonbirt, Tetbury (gr. Mr. A. Chapman). Brilliant crimson flowers of good form and substance.

To Hippeastrum 'Clovelly' (votes, unanimous), from Captain Holford, C.I.E., Westonbirt (gr. Mr. A. Chapman). A handsome white flower freely streaked and ribbed with rose pink.

To Tulipa Korolkowi bicolor (votes, unanimous), from Messrs. Wallace, Colchester. A new and very pleasing dwarf Tulip, with small globular

FIG. 133.—PRIMULA MEGASEÆFOLIA. (*Gardeners' Chronicle.*)

deep yellow flowers, blotched with scarlet at the base and shaded with orange-scarlet on the exterior of the petals.

Other Exhibits.

Mr. J. Roberts, Tan-y-Bwlch, N. Wales, sent flowers of Violet 'John Roberts,' a pale coloured sport from V. 'Marie Louise.'

Messrs. Paul, Cheshunt, sent a small group of Roses.

Messrs. Peed, West Norwood, sent flowering and foliage plants.

Mr. F. R. Silsbury, Clarendon Lodge, Shanklin, I.W., sent a specimen of Godwinia Gigas.

From Perry's Hardy Plant Farm, Winchmore Hill, came a small plant in flower of Eupatorium petiolare.

Mr. John Odell, Hillingdon, Uxbridge, sent Cyclamen 'Carmine King.'

FLORAL COMMITTEE, APRIL 9, 1901.

Mr. C. E. SHEA in the Chair, and twenty-three members present.

Awards Recommended:—

Silver-gilt Banksian Medal.

To Messrs. W. Paul, Waltham Cross, for forced hardy flowering trees and shrubs.

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for ornamental Japanese Cherries and blue Primroses.

To Messrs. Wallace, Colchester, for hardy flowers.

To Messrs. Cannell, Swanley, for zonal Pelargoniums.

Silver Banksian Medal.

To Messrs. Cutbush, Highgate, for double Tulips.

To Messrs. Jackman, Woking, for hardy flowers.

To Mr. H. J. Jones, Lewisham, for Daffodils and flowering plants.

Bronze Flora Medal.

To Messrs. House, Westbury-on-Trym, for Violets.

Award of Merit.

To Hippeastrum averunicus (votes, 12 for, 2 against), from Messrs. Jas. Veitch, Chelsea. A beautifully shaped scarlet flower slightly feathered with white, and striped with white down the centre of each segment.

To Hippeastrum 'Marathon' (votes, 10 for, 5 against), from Messrs. Jas. Veitch. A handsome variety with large rich crimson flowers.

To Hippeastrum 'Rialto' (votes 10 for, 1 against), from Messrs. Jas. Veitch. Flowers large rich scarlet, touched with crimson on the exterior of the broad segments.

To Tulipa violacea (votes, 8 for, 7 against), from Messrs. Barr, Covent Garden. A dwarf growing species from Persia, with small flowers with sharply pointed purplish-rose petals stained with deep indigo-blue at the base.

Cultural Commendation.

To Messrs. Jas. Veitch, Chelsea, for flowering specimens of Edgeworthia papyrifera.

Other Exhibits.

Lord Chesham, Latimer (gr. Mr. G. Neville), sent Tree Carnation 'Leonora,' a sport from 'Mrs. Leopold de Rothschild.'

From Miss Willmott, V.M.H., Great Warley, Essex, came Fritillaria Karelini and Chionodoxa Luciliæ Boissieri.

R. Staward, Esq., Danesfield, Walton-on-Thames, sent Primula cashmeriana Stawardi, the result of a cross between P. denticulata alba and P. cashmeriana.

Messrs. Paul, Cheshunt, sent Roses.

Mr. C. Bennett, Hayes, Middlesex, sent a group of seedling Polyanthus.

Floral Committee, April 23, 1901.

Mr. W. Marshall in the Chair, and twenty-five members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. Bain), for a collection of varieties of Anthurium scherzerianum.

Silver-gilt Banksian Medal.

To Messrs. Laing, Forest Hill, for forced flowering shrubs and foliage plants.

To Mr. Mount, Canterbury, for Roses.

To Messrs. Cuthbert, Southgate, for forced shrubs.

Silver Flora Medal.

To Messrs. Carter, Holborn, for Cinerarias.

To Messrs. Paul & Son, Cheshunt, for Roses.

To Messrs. Cutbush, Highgate, for forced shrubs and flowering plants.

To Mr. Rumsey, Waltham Cross, for Roses.

Silver Banksian Medal.

To Mr. Jones, Lewisham, for Begonias and hardy bulbous flowers.

To Messrs. Frank Cant, Colchester, for Roses.

To Messrs. Jackman, Woking, for hardy flowers.

To Messrs. Wallace, Colchester, for hardy flowers.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Messrs. Williams, Upper Holloway, for forced shrubs.

FIG. 134.—IRIS WILLMOTTIANA. (*Gardeners' Chronicle.*)

(*To face page* lxxiii.)

Bronze Banksian Medal.

To Messrs. Hill, Lower Edmonton, for Ferns.

To Messrs. Ware, Feltham, for hardy flowers.

Award of Merit.

To Arabis aubrietioides (votes, unanimous), from Miss Willmott, V.M.H., Warley Place, Essex. A compact free growing variety, with an abundance of stout spikes of pretty pale pink flowers.

To Iris Willmottiana (votes, 13 for, 4 against), from Miss Willmott, V.M.H. An early flowering Iris about a foot high, with pale mauve flowers with darker veinings, the lip blotched with white; leaves long, arching, glossy green, distinctly edged with white. (Fig. 134.)

To Rhododendron Aucklandii hybrida 'Godman' (votes, unanimous), from F. D. Godman, Esq., F.R.S., South Lodge, Horsham (gr. Mr. Moody). This differs from the type in bearing a larger and looser truss, the individual flowers also being larger, and much more deeply stained with pink in a young state.

To Primula obconica 'Kenmore strain' (votes, unanimous), from the Marchioness of Breadalbane, Taymouth Castle (gr. Mr. W. Wright). A very fine strain, with large trusses of variously coloured flowers borne on long stiff stems.

To Erythronium giganteum Hartwegi (votes, 12 for, 2 against), from H. J. Elwes, Esq., F.R.S., Colesborne Park, Cheltenham. An uncommon variety, with large white flowers with a sulphur-yellow centre.

To Border Carnation 'May' (votes, 7 for, 5 against), from Messrs. James, Farnham Royal. Large beautifully shaped fragrant white flowers; the foliage is long and slender.

To Berberis congestiflora hakeoides (votes, 10 for, 8 against), from Messrs. Jas. Veitch, Chelsea. A rather rare evergreen hardy Barberry, introduced from Chili exactly forty years ago. It forms a stout bush, from 4 to 6 feet high, with arching shoots and pale green prickly leaves. Its globular heads of small golden-yellow flowers appear in the axils of the leaves in early spring, and last in good condition for a considerable time.

To Primula viscosa 'Mrs. J. H. Wilson' (votes, unanimous), from Mr. J. H. Wilson, Handsworth, Sheffield. A very pretty dwarf Primrose, scarcely more than five inches high, with bold trusses of purple flowers with a conspicuous white eye.

Cultural Commendation.

To Mr. W. Bain, gr. to Sir Trevor Lawrence, Bart., Burford, Dorking, for a very fine plant of Anthurium scherzerianum Burfordiense.

To Mr. Moody, gr. to F. D. Godman, Esq., F.R.S., South Lodge, Horsham, for Sarmienta repens.

Other Exhibits.

Mrs. Currie, Trinity Cottage, Edinburgh (gr. Mr. A. McMillan), sent some beautiful hybrid greenhouse Rhododendrons.

Mrs. Powys Rogers, Burncoose, Perranwell, sent flowers of Rhododendron Dalhousie, an interesting epiphytal species from the Himalayas.

Sir Francis T. Barry, Bart., M.P., St. Leonard's Hill, Windsor (gr. Mr. Brown), sent Camellias grown in the open air.

W. Roupell, Esq., Roupell Park, S.W., sent a well berried plant of Aucuba japonica var.

Mrs. J. Cutler, 82 Tulse Hill, S.W., sent Polyanthuses.

From Messrs. Jas. Veitch, Chelsea, came a group of hardy Azaleas and blue Primroses.

Messrs. Cannell, Swanley, sent zonal Pelargoniums and "Cactus flowered" Cinerarias.

Mr. H. B. May, Upper Edmonton, sent a group of the new Pteris cretica albo-lineata Alexandræ.

Mr. A. Waterer, Woking, sent an unnamed Rhododendron.

Mr. Mortimer, Farnham, sent a small collection of his own strain of Polyanthuses.

Messrs. Peed, West Norwood, sent forced Lilacs.

Messrs. House, Westbury-on-Trym, Bristol, sent Primroses and Polyanthuses.

Floral Committee, May 7, 1901.

Mr. W. Marshall in the Chair, and twenty-one members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To the Rt. Hon. Lord Rothschild, Tring Park (gr. Mr. E. Hill), for Callas.

To Messrs. Jas. Veitch, Chelsea, for hardy bulbous plants.

Silver-gilt Banksian Medal.

To Messrs. Ben. R. Cant, Colchester, for Roses.

Silver Flora Medal.

To Mr. C. Turner, Slough, for Alpine Auriculas.

To Messrs. Carter, High Holborn, for Cinerarias.

Silver Banksian Medal.

To Wilberforce Bryant, Esq., Stoke Park, Slough (gr. Mr. D. Kemp), for Hippeastrums.

To Mr. H. B. May, Upper Edmonton, for foliage and flowering plants.

To Messrs. Barr, Covent Garden, for Daffodils and Tulips.

To Messrs. W. Paul, Waltham Cross, for Roses.

To Mr. M. Prichard, Christchurch, for hardy flowers.

To Messrs. Cheal, Crawley, for sprays of flowering trees and shrubs.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Messrs. Hogg & Robertson, Dublin, for Tulips.

To Messrs. Wallace, Colchester, for hardy plants and Alpines.

To Messrs. Frank Cant, Colchester, for Roses.

To Messrs. Ware, Feltham, for hardy flowers.

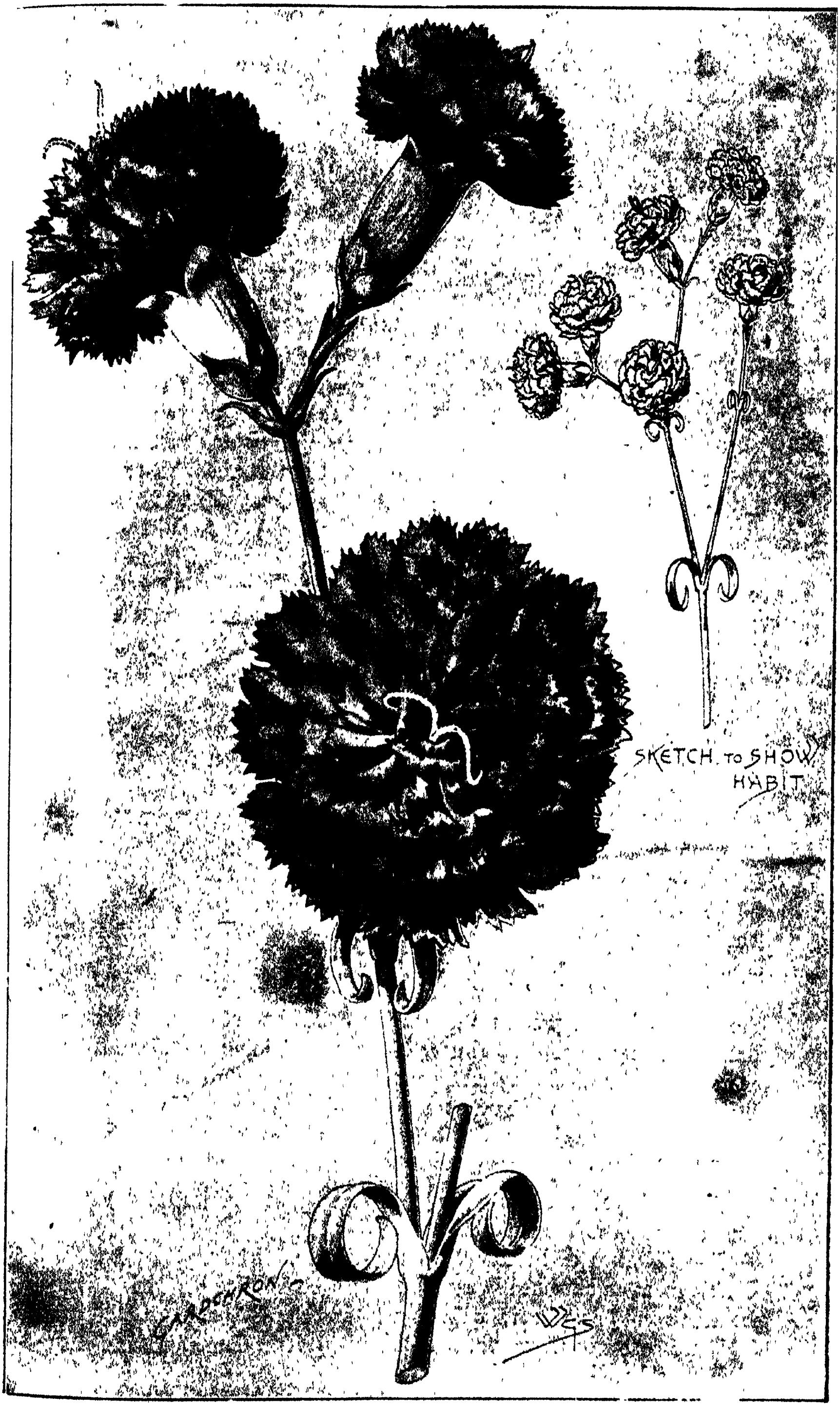


FIG. 185.—MULE PINK 'LADY DIXON.' (*Gardeners' Chronicle.*)

Bronze Flora Medal.

To Messrs. Cutbush, Highgate, for Calla Elliottiana.
To Messrs. Storrie & Storrie, Dundee, for Polyanthuses.
To Messrs. Jackman, Woking, for hardy flowers.
To Messrs. Paul & Son, Cheshunt, for Roses and hardy shrubs.
To Mr. H. J. Jones, Lewisham, for Daffodils and Tulips.

Bronze Banksian Medal.

To Mr. Percy R. Dunn, Brockley Park, Forest Hill, for Calceolarias.

Award of Merit.

To Mule Pink 'Lady Dixon' (votes, 14 for), from Percy D. Williams, Esq., Lanarth, St. Keverne. A particularly handsome plant, with perfectly double, sweet-scented, rosy-crimson flowers, with fimbriated petals, borne on stiff stems. It is very floriferous, and most interesting from the fact that it is the first recorded progeny obtained by crossing the common border Sweet William with a clove-scented Carnation. (Fig. 135.)

To Bunch Primrose 'Sultan' (votes, unanimous), from Miss Jekyll, V.M.H., Munstead Wood, Godalming (gr. Mr. A. Zumbach). This really remarkable plant produces an unusually fine truss of large substantial orange-yellow flowers with a deeper centre. The flower stems are very stout and about 10 inches long, and the foliage is broad and of a beautiful deep green. The plant exhibited was raised from seed sown in March, 1900.

To Single Tulip 'Brunhilde' (votes, unanimous), from Messrs. Barr, Covent Garden. A distinct variety, with bold cup-shaped flowers borne on stout stems; the colour is yellow, passing to creamy white. (Fig. 136.)

To Double Tulip 'William III.' (votes, 11 for, 2 against), from Messrs. Barr. Flowers large, quite double, and the colour rich orange-scarlet. It is one of the finest double scarlet Tulips in cultivation.

To Alpine Auricula 'Leonora' (votes, unanimous), from Mr. C. Turner, Slough. A pretty variety with well-formed petals; colour violet deepening to purple, with a distinct white eye.

To Borecole 'Albino' (votes, 11 for, 5 against), from Messrs. Storrie & Storrie, Dundee. A pretty plant for those who like ornamental Scotch Kales, differing from the ordinary forms in retaining its ornamental character as the flowering stems develop. It is said to be constant in character, and is quite as hardy as the green-leaved kitchen Kales.

Other Exhibits.

Colonel Brymer, Ilsington House, Dorchester, sent a remarkably fine truss of Rhododendron Nuttallii.

The Countess of Pembroke, Wilton House, Salisbury (gr. Mr. T. Challis), sent an unnamed Datura, bearing a bluish-lilac blossom, grown from seed sent home from the Transvaal—probably D. glabra.

The Duchess of Cleveland, Battle Abbey (gr. Mr. Camm), sent flowers of the Buckbean—Menyanthes trifoliata.

J. H. Buxton, Esq., Hunsdon Bury, Ware, sent Carnation 'Mrs. J. H. Buxton.' The Committee asked to see a plant in flower.

From H. Little, Esq., The Barons, Twickenham (gr. Mr. G. Watts), came a seedling Clivia.

The Hon. John Boscawen, Tregye, Cornwall, sent sprays of flowering shrubs.

FIG. 136.—TULIPA BRUNHILDE. (*Journal of Horticulture.*)

The Hon. Mrs. Evelyn Cecil, Didlington Hall, Brandon, sent Polyanthuses.

The Director, Royal Gardens, Kew, sent six very fine seedling Hippeastrums raised from seed sown in 1899.

Miss Jekyll, V.M.H., Munstead Wood, Godalming (gr. Mr. A. Zumbach), sent Primroses.

Messrs. Williams, Upper Holloway, sent foliage and flowering plants.

Mr. J. Russell, Kew Road, Richmond, sent a collection of Japanese Acers.

Messrs. Young, Cheshunt, sent a collection of Pansies and Violas.

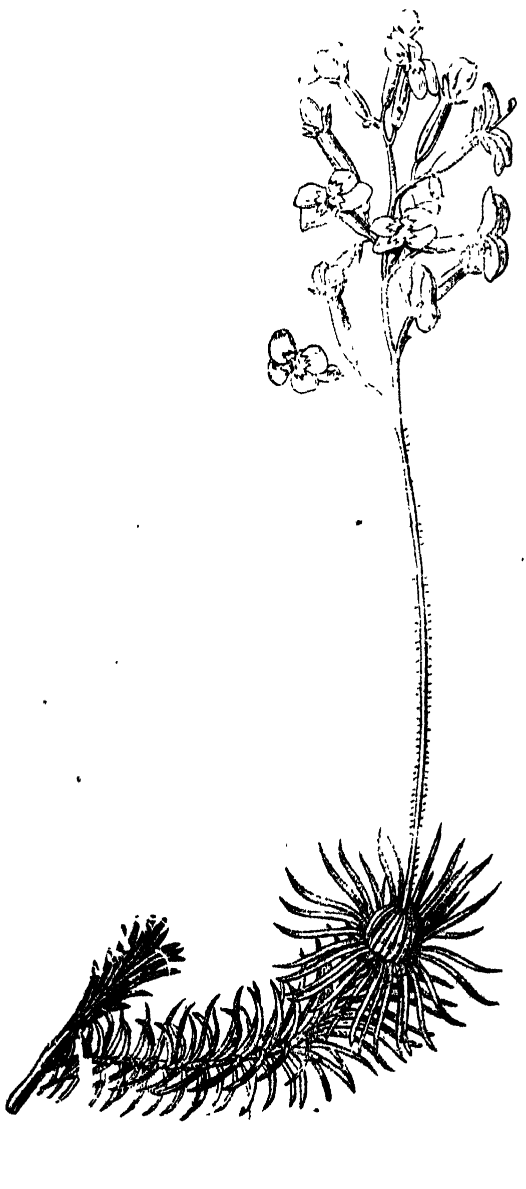
Messrs. Cuthbert, Southgate, sent Rhododendron (Azalea) leucanthum.

Messrs. Laing, Forest Hill, sent Japanese Acers.

Messrs. Low, Enfield, sent Schizanthus Wisetonensis.

Messrs. Peed. West Norwood, sent Alpines.

Mr. Drost, Richmond, sent hardy Azaleas.



ORCHID COMMITTEE.

ORCHID COMMITTEE, JANUARY 15, 1901.

Mr. HARRY J. VEITCH in the Chair, and eighteen members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Cypripediums, Lælio-Cattleyas, &c.

Award of Merit.

To Odontoglossum × loochristyense var. 'Fairy Queen' (votes, unanimous), from Mrs. Briggs-Bury, Bank House, Accrington (gr. Mr.

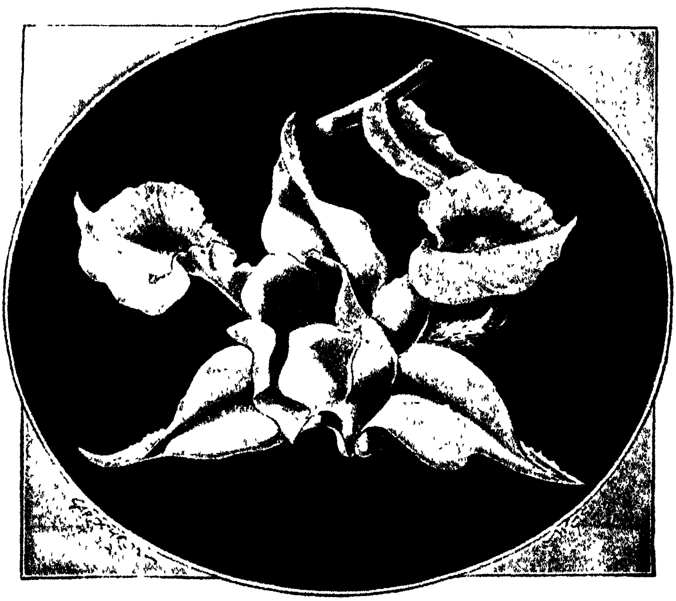


FIG. 137.—DENDROBIUM ASHWORTHIÆ. (*Gardeners' Chronicle.*)

Wilkinson). Flowers large, light yellow, blotched with brown. A natural hybrid.

To Dendrobium Ashworthiæ (votes, unanimous), from Elijah Ashworth, Esq., Harefield Hall, Wilmslow (gr. Mr. Holbrook). A New Guinea species of the general appearance of D. macrophyllum (Veitchianum). Sepals greenish white; petals stalked, pure white. Lip whitish, folded inward. Ovary downy. (Fig. 137.)

To Lycaste lasioglossa (votes, unanimous), from Messrs. Williams, Holloway. Sepals red-brown. Petals and lip yellow, the latter being hairy and marked with reddish spots.

To Lælia anceps Simondsii (votes, 9 for), from H. F. Simonds, Esq.,

Beckenham (gr. Mr. Geo. E. Day). Flowers of good form, pure white, with bluish lines on the side lobes, and a few small blue spots in front of the callus.

Cultural Commendation.

To Mr. Geo. E. Day, gr. to H. F. Simonds, Esq., Beckenham, for a fine plant of Dendrobium spectabile, with five spikes, bearing together thirty-five flowers.

Other Exhibits.

Baron Sir H. Schröder (gr. Mr. H. Ballantine) showed a group of Orchid blooms in which were the fine blotched Odontoglossum crispum 'Princess Christian' and O. c. Sanderianum.

Fred Hardy, Esq., Tyntesfield, Ashton-on-Mersey (gr. Mr. T. Stafford), showed an interesting collection of hybrid Cypripedium flowers.

H. S. Leon, Esq., Bletchley Park (gr. Mr. A. Hislop), showed Sophronitis grandiflora gigantea.

A. H. Smee, Esq., The Grange, Hackbridge (gr. Mr. Humphreys), sent Lælio-Cattleya × elegans, 'Smee's variety.'

Messrs. Hugh Low showed two pans of Cypripedium callosum and a plant of C. c. aureum, like a small pink-tinted C. c. Sanderæ.

W. Goodliffe, Esq., Worthing, showed Oncidium Sanderianum.

F. M. Burton, Esq., Gainsborough, sent Cattleya Walkeriana.

De B. Crawshay, Esq., Sevenoaks, showed Odontoglossum × Wilckeanum 'Lionel Crawshay.'

F. Bibby, Esq., Hardwicke Grange (gr. Mr. J. Taylor), sent flowers of Lælia anceps 'Lady Stanley Clarke,' a large coloured form.

C. D. Kemp Welsh, Esq. (gr. Mr. Guyatt), showed Cypripedium Spicerianum, 'Broadlands variety.'

Orchid Committee, January 29, 1901.

Mr. Harry J. Veitch in the Chair, and fourteen members present.

Awards Recommended.

Silver Flora Medal.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for an interesting group of Orchids.

Award of Merit.

To Calanthe × 'Oakwood Ruby' (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. Wm. Murray). A fine result of crossing C. vestita rubro-oculata and selecting the darkest for three generations. In this case it has resulted in reversing the order of colour in C. vestita, viz. white with dark ruby-red eye, 'Oakwood Ruby' being ruby-crimson with small white eye.

To Odontoglossum nevadense rosefieldiense (votes, unanimous), from De B. Crawshay, Esq., Sevenoaks. Flowers brown with yellow margin

and basal lines; lip white with brown spots, and a pale yellow fringe on the front lobe.

To Cattleya chocoensis alba (votes, unanimous), from Sir Frederick Wigan, Bart. Flowers white with pale yellow disc to the lip. The partially expanded segments and very broad petals render it distinct from C. Trianæi. It is also known in gardens as C. quadricolor and C. candida, Lehm.

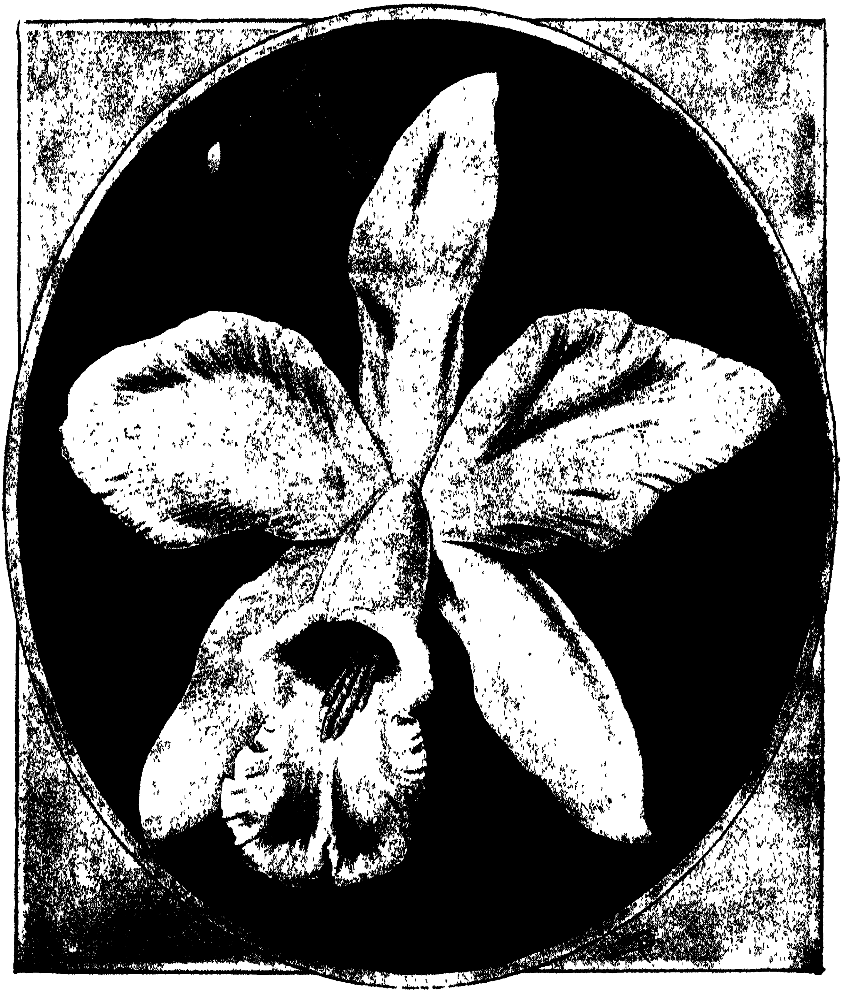


FIG. 138.—LÆLIA ANCEPS SCHRÖDERIANA. (*Gardeners' Chronicle.*)

Botanical Certificate.

To Phalænopsis Boxallii, from Sir Frederick Wigan, Bart. A curious species with short spikes of small yellowish flowers barred with brown.

Other Exhibits.

The Director of the Royal Gardens, Kew, sent a fine plant of a Madagascar Phaius, collected by M. Warpur. At Kew it has been

determined to be the original P. tuberculosus of Blume, and the one previously known under that name in gardens is called P. simulans, Rolfe. The chief difference is that the new arrival is of more tufted habit, and the older one has a tendency to a trailing growth.

Capt. C. C. Hurst, Hinckley, sent a number of varieties of Cypripedium × 'Adrastus' and other Cypripediums.

Reginald Young, Esq., Liverpool (gr. Mr. Poyntz), sent varieties of Lælia cinnabarina crosses.

J. Forster Alcock, Esq., Northchurch, showed Cypripedium × Bingleyense (Harrisianum superbum × Charlesworthii).

Walter Cobb, Esq., Tunbridge Wells (gr. Mr. J. Howes), sent

FIG. 139.—ODONTOGLOSSUM LOOCHRISTYENSE ROCHFORDIANUM.
(*Journal of Horticulture.*)

Cypripedium × 'Mary Beatrice' (× Gowerianum magnificum × bellatulum).

Mr. H. A. Tracy, Twickenham, showed Lycaste × Balliæ (plana × Skinneri).

De B. Crawshay, Esq., staged Odontoglossums and Lælia anceps Schröderiana. (Fig. 138.)

E. de Q. Quincey, Esq., sent Odontoglossum Londesboroughianum.

A. W. H. Hay, Esq. (gr. Mr. H. Pratt), showed flowers of a nearly white Dendrobium nobile.

J. Lumsden, Esq., Balmedie, Aberdeen, sent four hybrid Cypripediums.

Messrs. Heath, Cheltenham, staged a small group of Cypripediums and Dendrobiums.

Messrs. Hugh Low sent Cypripedium × Prewettii.

Norman C. Cookson, Esq., sent Calanthe × 'Phœbe.'

ORCHID COMMITTEE, FEBRUARY 12, 1901.

Mr. HARRY J. VEITCH in the Chair, and fourteen members present.

Awards Recommended.

First-class Certificate.

To Odontoglossum × loochristyense Rochfordianum (votes, unanimous), from Mr. T. Rochford, Turnford Hall, Broxbourne. An imported plant, considered to be a natural hybrid between O. triumphans and O. crispum. Flowers large, yellow, with white area at the base of the

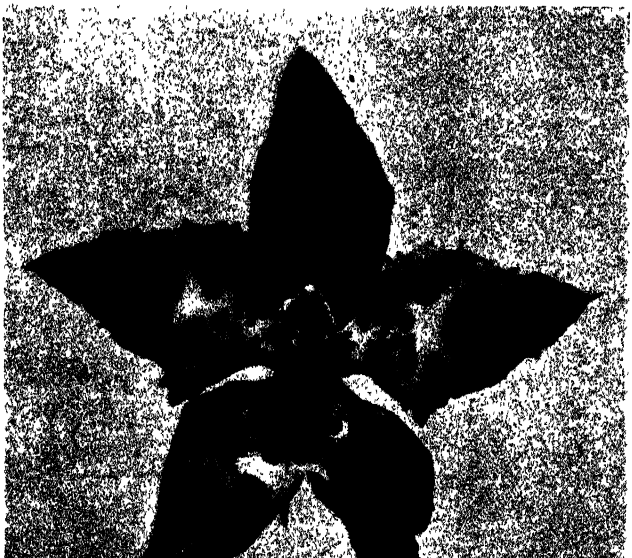


FIG. 140.—ODONTOGLOSSUM LOOCHRISTYENSE ROCHFORDIANUM. (*The Garden.*)

petals, and white labellum; all the segments blotched with red-brown crest yellow. (Figs. 139 and 140.)

Award of Merit.

To Odontoglossum × loochristyense coundonense (nat. hyb. triumphans × crispum) (votes, unanimous), from G. Singer, Esq., Coundon Court, Coventry (gr. Mr. Collier). Base of petals and lip white, the rest of the flower bright yellow with red-brown markings; petals fringed. The fine plant shown had a spike of seventeen flowers. (Fig. 141.)

To Dendrobium × Wiganianum (nobile × Hildebrandii) (votes, 7 for, 2 against), from Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young). Flowers white with rose-pink tips to the segments, and a small brown mark on each side of the base of the lip.

To Cypripedium × 'T. W. Bond,' 'Coundon Court variety'

(× Swanianum × hirsutissimum) (votes, 7 for, 6 against). Flowers large and partaking chiefly of C. hirsutissimum. Upper sepal greenish at base, white above, and with numerous blackish lines; petals bearing small blackish spots on the inner halves, tinged with rose on the outer portions. Lip tinged with rose on a whitish ground. (Fig. 142.)

Botanical Certificate.

To Eulophia pulchra, from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). Flowers whitish with purple veining on the lip.

To Angræcum hyaloides, from Jeremiah Colman, Esq., Gatton Park

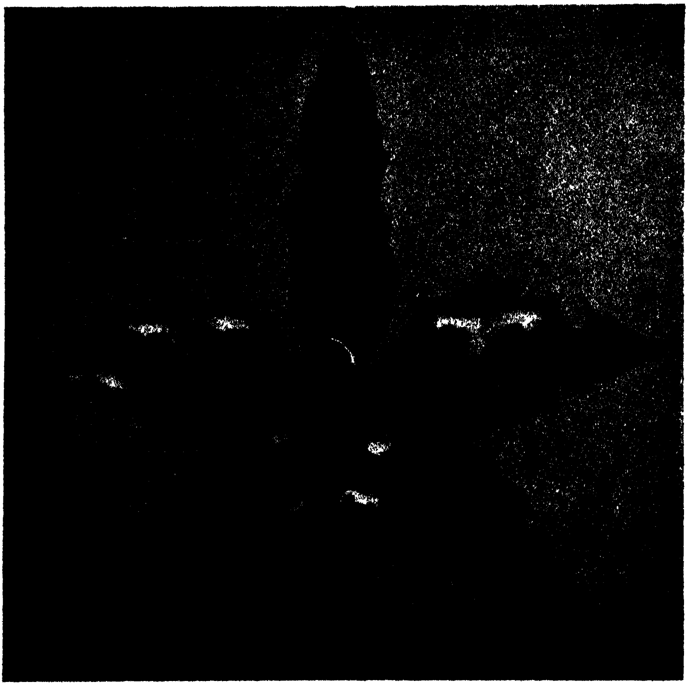


FIG. 141.—ODONTOGLOSSUM LOOCHRISTYENSE COUNDONENSE. (*The Garden.*)

(gr. Mr. W. P. Bound). A small species from Madagascar with ascendin racemes of small white flowers.

Other Exhibits.

Jeremiah Colman, Esq., showed good specimens of Zygopetalum Mackaii and Dendrobium × 'Juno' grandiflorum.

George Singer, Esq. (gr. Mr. Collier), showed some rare hybrid Cypripediums and other Orchids.

H. T. Pitt, Esq. (gr. Mr. Thurgood), sent two large specimens of Cypripedium × Savageanum (Harrisianum × Spicerianum), with flowers varying towards each parent.

J. Rutherford, Esq., Blackburn (gr. Mr. Lupton), showed two varieties of Odontoglossum × Adrianæ.

Walter Cobb, Esq., Tunbridge Wells (gr. Mr. J. Howes), sent Cypripedium × Schlesingerianum 'Bassano.'

Messrs. F. Sander, St. Albans, showed Cypripedium callosum Sanderæ; the pretty white Lælia præstans 'Queen Alexandra,' with slate-blue front to the labellum, and other varieties.

Fig. 142.—Cypripedium 'T. W. Bond,' Coundon Court variety. (*Journal of Horticulture.*)

Sir W. D. Pearson, Bart., M.P. (gr. Mr. Wadds), showed a good form of Cattleya Trianæi.

Messrs. Hugh Low sent Cattleya Trianæi 'Titania' and Cypripedium callosum giganteum.

De B. Crawshay, Esq., showed Odontoglossum Rossii 'Queen Alexandra.' A dark form with rose petals and lip.

Messrs. Heath, Cheltenham, showed a group of Orchids.

Messrs. B. S. Williams staged varieties of Lycaste Skinnerii, &c.

G. F. Moore, Esq. (gr. Mr. Morris), sent Cypripedium × Beekmanii and a fine Cattleya Percivaliana.

ORCHID COMMITTEE, FEBRUARY 26, 1901.

Mr. HARRY J. VEITCH in the Chair, and eighteen members present

Awards Recommended :—

Silver Gilt Flora Medal.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White), for group of the Burford hybrid Dendrobiums and other Orchids.

To Messrs. Jas. Veitch, Chelsea, for group of hybrid Orchids.

Silver Flora Medal.

To the Right Hon. Lord Aldenham (gr. Mr. Beckett), for a group of

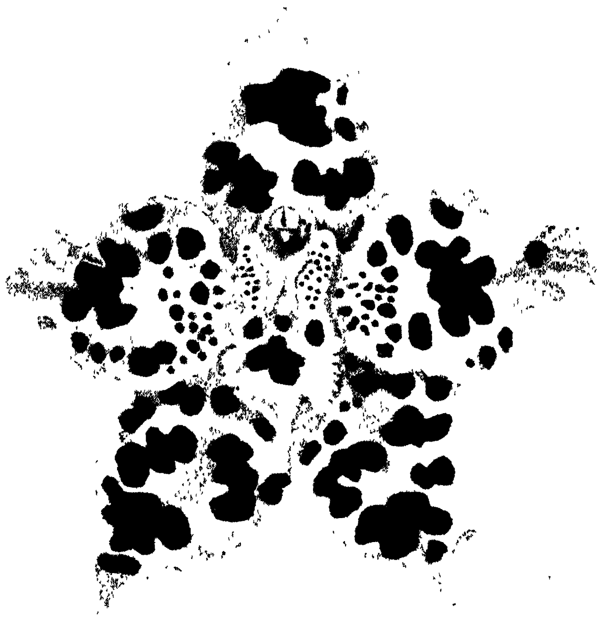


FIG. 143.—ODONTOGLOSSUM ADRIANÆ 'MRS. ROBERT BENSON.' (*Journal of Horticulture.*)

eight splendid specimens of Cœlogyne cristata, set up with scarlet Thyrsacanthus rutilans.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To J. Rutherford, Esq., M.P., Beardwood, Blackburn (gr. Mr. Lupton), for a group of varieties of Odontoglossum crispum and other Orchids.

To Messrs. Cypher, Cheltenham, for a group of Dendrobiums in flower.

First-class Certificate.

To Sophronitis grandiflora Rossiteriana (votes, 10 for, 2 against), from Sir Trevor Lawrence, Bart. The same plant of the yellow-flowered form which received an Award of Merit January 10, 1899.

To Lælio-Cattleya × warnhamensis (C. Trianæi × L. cinnabarina)

(votes, unanimous), from C. J. Lucas, Esq., Warnham Court (gr. Mr. Duncan). Flowers copper-coloured tinged with purple; lip purple. Award of Merit, March 8, 1898.

Award of Merit.

To Dendrobium × rubens grandiflorum (nobile nobilius × splendidissimum grandiflorum) (votes, unanimous), from Sir Trevor Lawrence, Bart. The best of its class. Flowers cream-white tinged with rose-purple; disc of lip dark crimson-purple.

To Odontoglossum × Adrianæ 'Mrs. Robert Benson' (votes, unanimous), from Captain Holford, Westonbirt, Tetbury (gr. Mr. A. Chapman). Flowers large; petals broad; cream-white edged with yellow and heavily spotted with brown. (Fig. 148.)

To Phaio-Calanthe × Schröderiana (P. Wallichii × C. × 'Baron Schröder') (votes, unanimous), from Messrs. Jas. Veitch. Sepals and petals white tinged with lilac; lip claret-purple.

To Odontoglossum × Coradinei 'Mrs. de B. Crawshay' (votes, 7 for, 3 against), from J. S. Moss, Esq., Wintershill, Bishop's Waltham. Flowers yellow blotched with brown.

Botanical Certificate.

To Cœlogyne sulphurea, from F. W. Moore, Esq., V.M.H., Royal Botanic Gardens, Glasnevin. Flowers, profusely borne on short racemes, tawny-yellow.

Cultural Commendation.

To Mr. E. Hill, gr. to the Right Hon. Lord Rothschild, Tring Park, for Phalænopsis Aphrodite, bearing a five-branched spike of twenty-four fine flowers.

To Mr. Beckett, gr. to the Right Hon. Lord Aldenham, for splendidly flowered Cœlogyne cristata.

Other Exhibits.

The Hon. Walter Rothschild showed an inflorescence of Schomburgkia undulata, 'Tring Park variety,' with a dense head of dark red-brown flowers.

J. S. Moss, Esq., showed a fine Lælia Jongheana.

J. T. Bennett-Poe, Esq. (gr. Mr. Downes), sent Cypripedium × 'Gaetano.'

J. Gurney Fowler, Esq. (gr. Mr. Davis), showed Cypripedium × 'Miss Louisa Fowler' and Cochlioda Noezliana, 'Glebelands variety.'

C. L. N. Ingram, Esq., Elstead House, Godalming (gr. Mr. T. W. Bond), showed Cattleya × 'Zephyra' (Schröderæ × aurea).

E. de Q. Quincey, Esq. (gr. Mr. Lees), sent a hybrid Cypripedium.

Mr. J. Weathers, Isleworth, showed as Phaius Warpuri the plant previously named P. tuberculosus.

Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young), sent Phaius simulans, Rolfe.

Messrs. F. Sander showed a hybrid Zygopetalum and other Orchids.

ORCHID COMMITTEE, MARCH 12, 1901.

Mr. HARRY J. VEITCH in the Chair, and sixteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Jas. Veitch for a fine group of Orchids.

Silver Floral Medal.

To H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood), for a group of Orchids.

FIG. 144.—ODONTOGLOSSUM CRISPUM VAR. 'QUEEN EMPRESS.' (*Journal of Horticulture.*)

To W. Thompson, Esq., Stone, Stafford (gr. Mr. Stevens), for a group of Odontoglossums.

To Messrs. Hugh Low for a group of Orchids.

To Mr. J. Cypher, Cheltenham, for a group of Dendrobiums.

Silver Banksian Medal.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To R. G. Thwaites, Esq., Streatham (gr. Mr. Black), for a group of Orchids.

To Mrs. T. B. Haywood, Reigate (gr. Mr. Salter), for a group of Orchids.

First-class Certificate.

To Odontoglossum crispum 'Queen Empress' (votes, unanimous), from W. Thompson, Esq., Stone (gr. Mr. Stevens). A very fine rose-tinted form of typical O. crispum. (Fig. 144.)

To Cypripedium × W. R. Lee, 'Sander's variety' (Rothschildianum

FIG. 145.—CYPRIPEDIUM 'LORD DERBY,' SANDER'S VARIETY. (*Journal of Horticulture.*)

× superbiens) (votes, unanimous), from Messrs. F. Sander. A fine form of the variety known as 'Lord Derby,' certificated August 13, 1895. (Fig. 145.)

Award of Merit.

To Lælio-Cattleya × 'Vacuna' (C. guttata × L. cinnabarina) (votes,

unanimous), from Messrs. Jas. Veitch. Sepals and petals yellow; front of lip crimson purple.

To Cypripedium × 'Ernesto' (parentage unrecorded) (votes, unanimous), from Frank A. Rehder, Esq., Gipsy Hill (gr. Mr. Norris). Flower tinged with a glossy brown tint; margin of upper sepal white.

To Dendrobium × Ainsworthii Edithæ (aureum × nobile nobilius) (votes, unanimous), from Mrs. Haywood, Reigate (gr. Mr. Salter). Flowers larger and more tinged with rose than ordinary D. × Ainsworthii.

To Dendrobrium × Roeblingianum (Ruckeri × nobile) (votes, 7 for, 2 against), from R. G. Thwaites, Esq., Streatham (gr. Mr. Black). Sepals white; petals white tinged with rose; lip white, with yellow downy disc and purple markings.

Botanical Certificate.

To Liparis tricallosa, from Sir Trevor Lawrence, Bart. (gr. Mr. W. H.

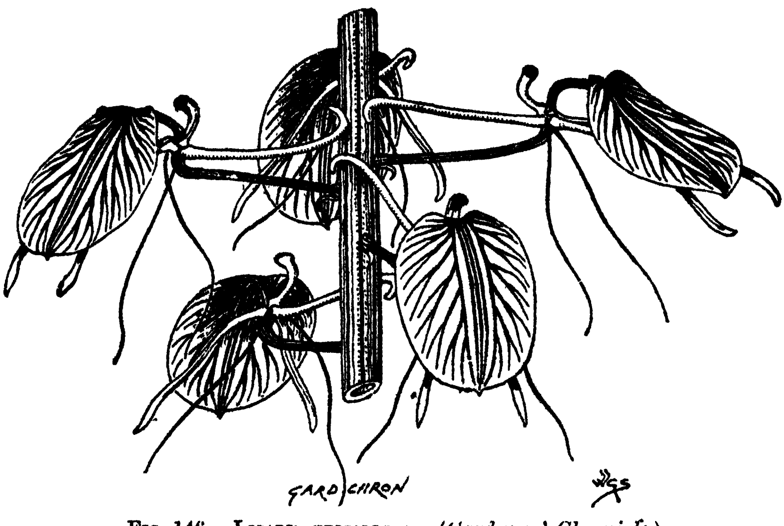


FIG. 146.—LIPARIS TRICALLOSA. (*Gardeners' Chronicle.*)

White). A singular species with erect spikes of whitish flowers marked with brown. (Fig. 146.)

Other Exhibits.

Sir Trevor Lawrence, Bart., showed Odontoglossum coronarium miniatum, and other fine Odontoglossums.

Captain Holford, Westonbirt (gr. Mr. Chapman), showed Cymbidium × eburneo-Lowianum, finely flowered.

M. Florent Claes, Brussels, showed a collection of Odontoglossums.

ORCHID COMMITTEE, MARCH 26, 1901.

Mr. HARRY J. VEITCH in the Chair, and sixteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To M. Jules Hye De Crom, of Ghent (gr. Mr. Coen), for Odontoglossum

crispum 'Franz Masereel,' with a spike of thirteen fine owers blotched with claret-purple. The plant was awarded a First-class Certificate November 13, 1894. (Fig. 147.)

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a group of Orchids, principally hybrids.

Silver Banksian Medal.

To Messrs. Hugh Low, Bush Hill Park, for a group of Cattleyas, Dendrobiums, &c.

First-class Certificate.

To Odontoglossum crispum purpurescens (votes, unanimous), from

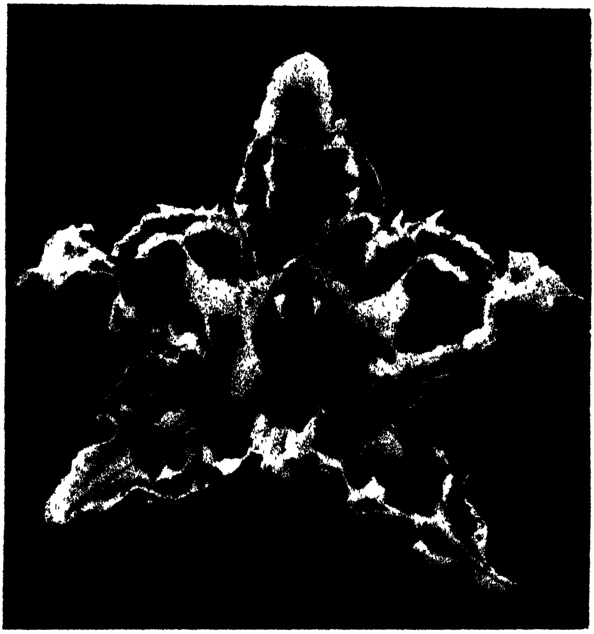


FIG. 147.—ODONTOGLOSSUM CRISPUM 'FRANZ MASEREEL.' (*The Garden.*)

Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White). A very distinct and beautiful form, for which an Award of Merit was given June 27, 1899. Good culture had improved the flowers in every respect. Sepals slightly, and petals heavily fringed; rosy lilac changing to white towards the margin. Sepals marked with many confluent reddish-purple spots; petals similarly marked with fewer spots; lip white, with yellow crest and red-brown spots. (Fig. 148.)

To Lælia Jongheana Kromeri (votes, unanimous), from Mr. Ed. Kromer, Bandon Hill, Croydon. Flowers bright rose-purple. (Fig. 149.)

Award of Merit.

To Odontoglossum crispum 'Sunshine' (votes, unanimous), from Messrs. Sander, St. Albans. Flowers large and finely formed; canary-

yellow, with a purplish tinge on the backs of the sepals and a brown blotch on the lip.

Cultural Commendation.

To Mr. Geo. Day, gr. to H. F. Simonds, Esq., Beckenham, for four splendid plants of Dendrobium Jamesianum, bearing together upwards of one hundred and fifty large white flowers with yellow centres.

To Mr. Humphreys, gr. to A. H. Smee, Esq., Carshalton, for a fine mass of Scuticaria Hadwenii with six flowers.

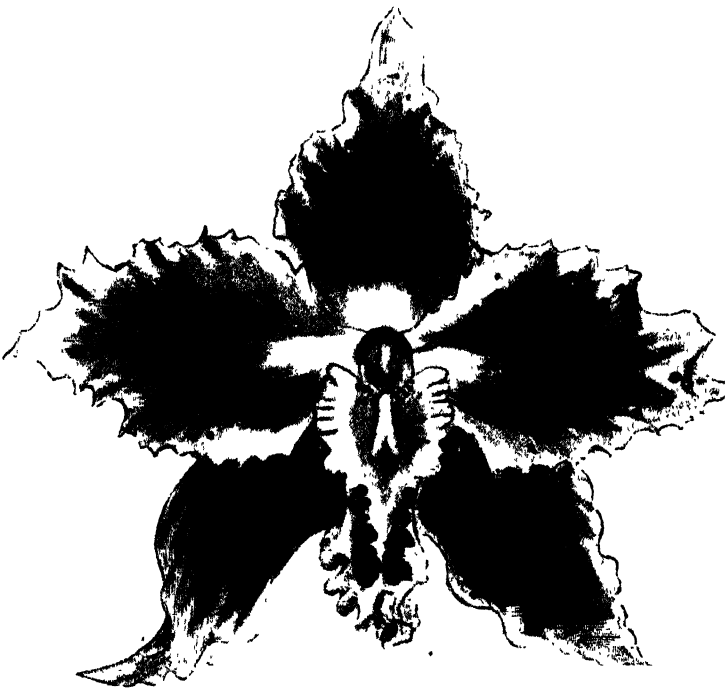


FIG. 148.—ODONTOGLOSSUM CRISPUM VAR. PURPURESCENS. (*Journal of Horticulture.*)

To Mr. W. Stevens, gr. to W. Thompson, Esq., Walton Grange, Stone, Stafford, for Odontoglossum crispum 'Victoria Regina.'

Other Exhibits.

Sir Trevor Lawrence, Bart., showed a highly interesting group of pretty and curious Orchids, serving to illustrate Mr. White's lecture on "Inconspicuous and Rarely-cultivated Orchids."

Sir Jas. Miller, Bart., Duns (gr. Mr. J. Hamilton), sent two good varieties of Lælio-Cattleya × highburiensis.

Sir F. Wigan, Bart. (gr. Mr. W. H. Young), showed flowers of Lælio-Cattleya × Digbyano-Trianæi, and L.-C. × 'Louis Chaton' var. 'Cecilia.'

Drewett O. Drewett, Esq., Riding Mill-on-Tyne (gr. Mr. R. Etty), sent Cypripedium × 'Robert Etty' (Godefroyæ × insigne Chantinii) and other Cypripediums.

Messrs. Sander showed a group of hybrid Phaius and Odontoglossums.

J. Bradshaw, Esq., Southgate (gr. Mr. Whitelegge), sent fine forms of Cattleya Trianæi.

R. I. Measures, Esq. (gr. Mr. H. J. Chapman), sent Cypripedium × 'Zeus.'

M. Lucien Linden, Brussels, sent four Phalænopsis amabilis.

Mr. A. J. Keeling, Bingley, showed varieties of Lælia Jongheana

FIG. 149.—LÆLIA JONGHEANA KROMERI. (*Journal of Horticulture.*)

Walter Cobb, Esq., Tunbridge Wells (gr. Mr J. Howes), showed the finely blotched Odontoglossum crispum Elamii and O. trimphans dulcotensis.

A. H. Smee, Esq. (gr. Mr. Humphreys), sent Lælio-Cattleya × 'Pallas' with dissimilar flowers.

Mrs. Haywood, Reigate (gr. Mr. C. J. Salter), showed Dendrobium splendidissimum 'Mrs. Haywood' and D. × 'Virgil.'

H. M. Pollett, Esq., Bickley (gr. Mr. Fry), sent a finely flowered pseudobulb of Dendrobium Wardianum.

ORCHID COMMITTEE, APRIL 9, 1901.

Mr. HARRY J. VEITCH in the Chair, and sixteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To W. A. Bilney, Esq., Fir Grange, Weybridge (gr. Mr. Whitlock), for a fine group of Dendrobiums, &c.

To De B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. W. J. Stables), for the fine Odontoglossum triumphans 'Lionel Crawshay,' excellently well grown.

To Major Joicey, Sunningdale Park, Sunningdale (gr. Mr. F. J. Thorne), for a group composed principally of twenty profusely flowered Dendrobium atro-violaceum, the largest bearing one hundred and twenty-five flowers.

Silver Flora Medal.

To Baron Sir H. Schröder, The Dell, Staines (gr. Mr. H. Ballantine), for a collection of rare Odontoglossums.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a fine group of Orchids.

To Messrs. Jas. Veitch, Chelsea, for a group showing three generations of crosses from Epidendrum Endresii and E. Wallisii.

Silver Banksian Medal.

To W. Thompson, Esq., Walton Grange, Staffordshire (gr. Mr. W. Stevens), for a collection of rare Odontoglossums.

First-class Certificate.

To Lælia Jongheana Ashworthiæ (votes, unanimous), from Elijah Ashworth, Esq., Harefield Hall, Wilmslow (gr. Mr. Holbrook). Flowers white, with orange-coloured base and crest to the labellum.

To Cattleya × 'Miss Harris var. E. Ashworth' (Schilleriana × Mossiæ) (votes, unanimous), from Elijah Ashworth, Esq. (gr. Mr. Holbrook). Flowers resembling Cattleya Schilleriana more than C. Mossiæ; rose-purple with claret-purple veining on the lip, which has a yellow disc in the centre.

To Epidendrum × 'Clarissa' superbum (Wallisii ♀, elegantulum ♂) (votes, unanimous), from Messrs. Jas. Veitch. Flowers nearly as large as those of E. Wallisii. Sepals and petals yellow, tinged and spotted with dark purple ; lip violet colour. (Fig. 150.)

Award of Merit.

To Odontoglossum × Ruckerianum 'Mrs. R. Brooman-White' (votes, 8 for, 3 against), from R. Brooman-White, Esq., Garelochhead. Flowers of good shape, cream tinged with rose ; sepals and petals evenly spotted with dark red.

To Odontoglossum × Adrianæ 'Mrs. Simonds' (votes, unanimous), from H. F. Simonds, Esq., Woodthorpe, Beckenham (gr. Mr. Geo. Day). Flowers pale yellow, unspotted except for one spot on the upper sepal and a few small ones on the lip.

To Masdevallia × 'Alceste' (Veitchiana × 'Asmodia') (votes, unanimous), from Messrs. Jas. Veitch. Flowers nearly as large as those of M. Veitchiana; dark red on orange ground.

To Odontoglossum × Denisoniæ nebula (votes, 10 for, 1 against), from De B. Crawshay, Esq., Sevenoaks (gr. Mr. Stables). Flowers white with light brown spots. Probably a second cross of O. × Wilckeanum.

To Odontoglossum × loochristyense 'Mrs. De B. Crawshay' (votes

FIG. 150.—EPIDENDRUM × CLARISSA SUPERBUM. (*Journal of Horticulture.*)

7 for, 5 against). In colour and form approaching O. triumphans, but with less red-brown marking on the flowers.

To Miltonia vexillaria, 'Rosslyn variety' (votes, 10 for, 4 against), from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). Flowers large, almost entirely of a bright rose-purple colour.

Cultural Commendation.

To Mr. J. May, gr. to J. B. Joel, Esq., Potter's Bar, for a grand plant of Cypripedrum Rothschildianum with seven flowers.

To Mr Knowles, gr. to F. Crisp, Esq., Friars Park, Henley-on-Thames, for a large specimen of Lycaste Skinnerii with about thirty flowers.

Other Exhibits.

W. P. Burkinshaw, Esq., Hessle (gr. Mr. Barker), showed some good Cattleyas, &c.

Elijah Ashworth, Esq. (gr. Mr. Holbrook), sent varieties of Odontoglossum × Adrianæ and Cypripediums.

De B. Crawshay, Esq. (gr. Mr. Stables), showed a group of good Odontoglossums.

J. Forster Alcock, Esq., Northchurch, showed Cypripedium × Fraserii.

C. A. Smith Ryland, Esq., Warwick (gr. Mr. R. Jones), showed several hybrid Cypripediums.

Captain Holford, Westonbirt (gr. Mr. A. Chapman), sent Odontoglossum × Adrianæ 'Countess Grey' and other Orchids.

Mrs. Haywood, Woodhatch, Reigate (gr. Mr. C. J. Salter), showed varieties of Dendrobium × 'Cybele' and two Lælio-Cattleyas.

H. F. Simonds, Esq. (gr. Mr. Geo. Day), showed Odontoglossum × Andersonianum, 'Woodthorpe variety.'

R. G. Thwaites, Esq., Streatham (gr. Mr. Black), sent Dendrobium × Euryalus, 'Thwaites variety.'

ORCHID COMMITTEE, APRIL 23, 1901.

Mr. HARRY J. VEITCH in the Chair, and sixteen members present.

Awards Recommended:—

Gold Medal.

To Mr. Thos. Rochford, Turnford Hall, Broxbourne, for a magnificent group of Odontoglossums, consisting of over two hundred splendidly flowered specimens.

Silver Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a group of Orchids.

To De B. Crawshay, Esq., Sevenoaks (gr. Mr. Stables), for a collection of Odontoglossums.

Silver Banksian Medal.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Lælias and Lælio-Cattleyas.

To R. Brooman-White, Esq., Arddarroch, Garelochhead, for a fine selection of spikes of Odontoglossums.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White), for a group of rare Orchids.

To Messrs. Hugh Low, Bush Hill Park, for a group of Orchids.

Bronze Banksian Medal.

To Messrs. Williams, Holloway, for a group of Vandas, &c.

First-class Certificate.

To Odontoglossum luteo-purpureum, 'Coundon Court variety' (votes, unanimous), from Geo. Singer, Esq., Coundon Court, Coventry (gr. Mr. Collier). Sepals dark chocolate-brown with yellow margin and tips. Petals light yellow spotted with dark brown. Lip white in front, yellow at the base, fringed, and bearing light brown blotches.

Award of Merit.

To Odontoglossum luteo-purpureum, 'Burford variety,' from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). Flowers large, yellowish, barred and blotched with dark brown. Lip fringed; primrose colour with brown spotting.

To Odontoglossum × Adrianæ Crawshayanum (votes, unanimous), from De B. Crawshay, Esq. (gr. Mr. Stables). Segments white on

FIG. 151.—ODONTOGLOSSUM × ADRIANÆ CRAWSHAYANUM. (*Journal of Horticulture.*)

the inner and yellow on the outer parts, spotted with purple brown. (Fig. 151.)

To Odontoglossum × Wilckeanum, 'Turnford Hall variety' (votes, unanimous), from Mr. Thos. Rochford. Flowers light yellow, petals and lip fringed, the sepals bearing many and the lip and petals a few brown blotches.

To Odontoglossum crispum 'Edward VII.' (votes, unanimous), from Mr. Thos. Rochford. Flowers white tinged with purple, and bearing reddish-purple spotting.

To Oncidium Marshallianum sulphureum (votes, unanimous), from Walter Cobb, Esq., Tunbridge Wells (gr. Mr. J. Howes). Flowers almost wholly bright yellow, the usual brown marking being suppressed and the spotting shown only by a greenish tint.

To Laelio-Cattleya × 'Cybele' (L.-C. × Schilleriana × C. Trianæi) (votes, unanimous), from Messrs. Jas. Veitch. Flowers large and of good

form. Sepals and petals white tinged with lavender colour. Front of lip marbled and veined with ruby-purple; disc chrome-yellow.

Other Exhibits.

Lord Llangattock, The Hendre, Monmouthshire (gr. Mr. Coomber), sent Cypripedium 'Lady Llangattock' (Lawrenceanum ♂, selligerum ♀).

Sir Jas. Miller, Bart., Manderston, Duns, N.B. (gr. Mr. J. Hamilton), sent a fine specimen of Lælio-Cattleya × 'Lady Miller' (L. cinnabarina × C. granulosa Schofieldiana).

H. F. Simonds, Esq., Beckenham (gr. Mr. G. Day), showed plants of Cyrtopodium punctatum in flower.

Frank A. Rehder, Esq., Gipsy Hill (gr. Mr. Norris), sent Cypripedium × 'Ida.'

Col. Shipway (gr. Mr. Walters) showed Masdevallia Schlimii.

W. M. Appleton, Esq., showed Cypripedium × 'Vipani.'

A. S. Hitchins, Esq., St. Austell, sent Odontoglossum × elegantius.

Mrs. J. Douglas showed cut spikes of Phaius × 'Norman' and P. × Cooksonii.

Geo. Singer, Esq. (gr. Mr. Collier), showed hybrid Cypripediums.

Sir Wheetman Pearson, Bart. (gr. Mr. Wadds), sent several fine specimens of Cattleya Lawrenceana.

Orchid Committee, May 7, 1901.

Mr. J. Gurney Fowler in the Chair, and eighteen members present.

Awards Recommended.—

Silver-gilt Flora Medal.

To J. Leemann, Esq., West Bank House, Heaton Mersey (gr. Mr. Edge), for a fine group of Odontoglossums and other Orchids.

Silver Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a group of Orchids.

To De Barri Crawshay, Esq., Sevenoaks (gr. Mr. Stables), for a group of rare Odontoglossums.

First-class Certificate.

To Lælio-Cattleya × Digbyano-Mendelii, 'Tring Park variety' (votes, unanimous), from the Honble. Walter Rothschild, M.P. Flower larger than the original form, blush-white; lip deeply fringed.

To Odontoglossum Hallii 'Edward VII.' (votes, unanimous), from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). A very large flower, yellowish white, heavily marked with chocolate-purple. Lip very broad, white, with yellow crest, and brown markings.

To Cattleya Schröderæ heatonensis (votes, 13 for, 2 against), from H. T. Pitt, Esq. (gr. Mr. Thurgood). Flowers pale lilac with primrose-yellow centre to the lip; petals and lip finely crimped.

To Odontoglossum × Adrianæ Cobbianum (votes, unanimous), from

Walter Cobb, Esq., Tunbridge Wells (gr. Mr. J. Howes). The darkest in colour. Flowers yellowish, heavily blotched with dark brown.

To Odontoglossum crispum 'Confetti' (votes, 10 for, 4 against), from

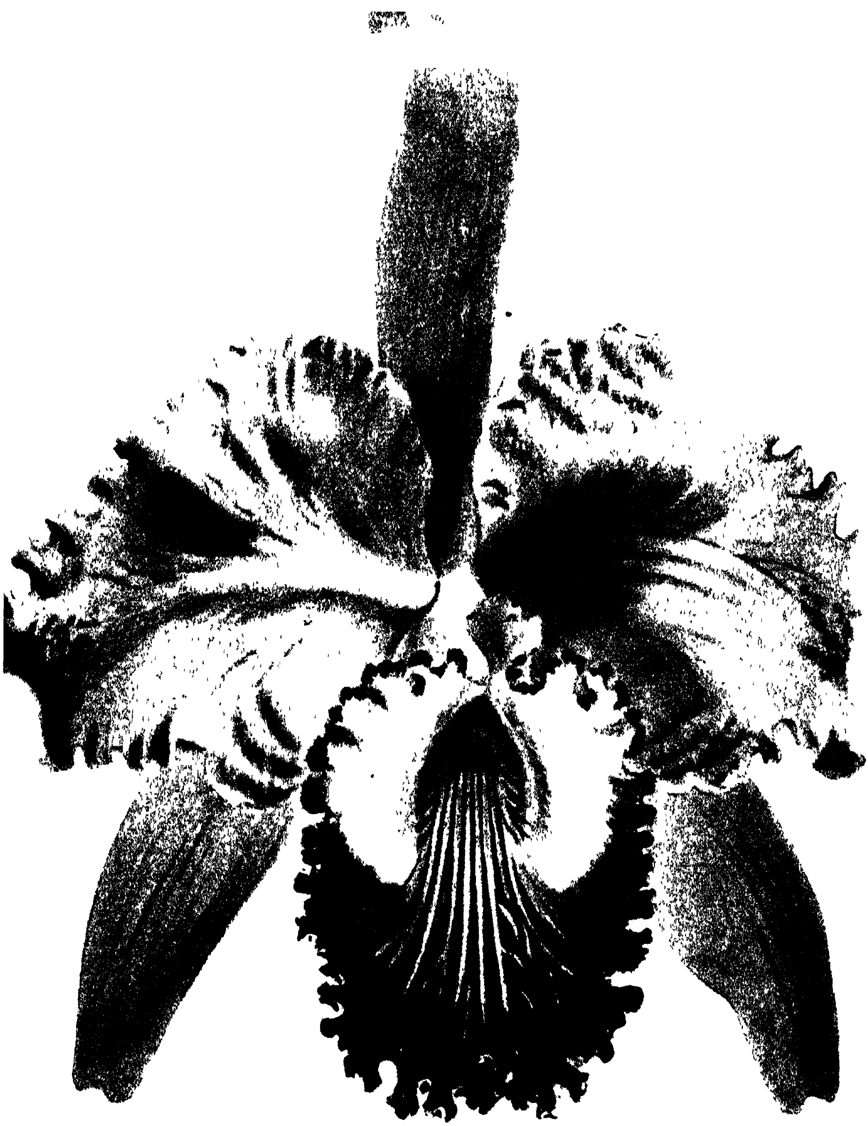


FIG. 152.—CATTLEYA MENDELII 'QUEEN ALEXANDRA.' (*Journal of Horticulture.*)

J. Leemann, Esq., Heaton Mersey (gr. Mr. Edge). Flowers white, tinged with rose and blotched with reddish purple.

Award of Merit.

To Lælia × Mrs. Gratrix, 'Tring Park variety' (votes, unanimous), from the Honble. Walter Rothschild, M.P. Inflorescence three-flowered

Flowers larger than ordinary forms, and of a reddish-orange colour; lip fringed.

To Odontoglossum crispum 'Domino' (votes, unanimous), from J. Leemann, Esq., Heaton Mersey (gr. Mr. Edge). Flowers white with dark purplish blotches.

To Odontoglossum crispum 'Countess of Derby' (votes, unanimous), from J. Leemann, Esq. (gr. Mr. Edge). Flowers white tinged with rose, and evenly spotted with dark purplish blotches.

To Odontoglossum crispum 'Raymond Crawshay' (votes, unanimous), from De B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. Stables). A fine rose-tinted flower, heavily blotched with reddish-orange colour.

To Sobralia Ruckerii (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White). A rare and handsome species. Sepals and petals pale rose-purple; lip white at the base, and with a showy yellow band running up the centre; front of the lip bright dark-rose-purple.

To Brasso-Cattleya × nivalis (Brassavola fragrans × Cattleya intermedia) (votes, unanimous), from J. Leemann, Esq., Heaton Mersey (gr. Mr. Edge). Plant and flowers resembling the natural hybrid Brasso-Cattleya × Lindleyana. Flowers white.

To Cattleya Mendelii 'Queen Alexandra' (votes, 11 for, 5 against), from Mr. H. A. Tracy, Twickenham. A light-coloured large flower with the margin of the lip and the tips of the petals tinged with purple. (Fig. 152.)

Botanical Certificate.

To Oncidium stramineum, from Frau Ida Brandt, Zürich (gr. Mr. Schlecht). Flowers yellowish, spotted with dark red.

Cultural Commendation.

To Mr. R. B. Leech, Dulwich, for a fine plant of Epidendrum Wallisii in flower.

Other Exhibits.

Messrs. Jas. Veitch staged a fine group of Orchids.

Messrs. Hugh Low showed a group of Cattleyas and other Orchids.

Baron Sir H. Schröder (gr. Mr. H. Ballantine) sent a fine inflorescence of Cymbidium pendulum atropurpureum.

W. W. Mann, Esq., Bexley, showed Odontoglossum crispum Mannii, white, with one large brown spot in each segment.

Frank A. Rehder, Esq., Gipsy Hill (gr. Mr. Norris), showed a yellow-tinted Dendrobium Wardianum.

Major Joicey, Sunningdale Park (gr. Mr. F. J. Thorne), showed a finely flowered specimen of Diacrium (Epidendrum) bicornutum and Dendrobium macrophyllum.

Frank W. Mason, Esq., Warwick, sent flowers of good Cattleya Mendelii.

J. Gurney Fowler, Esq. (gr. Mr. J. Davis), sent Dendrobium macrophyllum, 'Glebelands variety.'

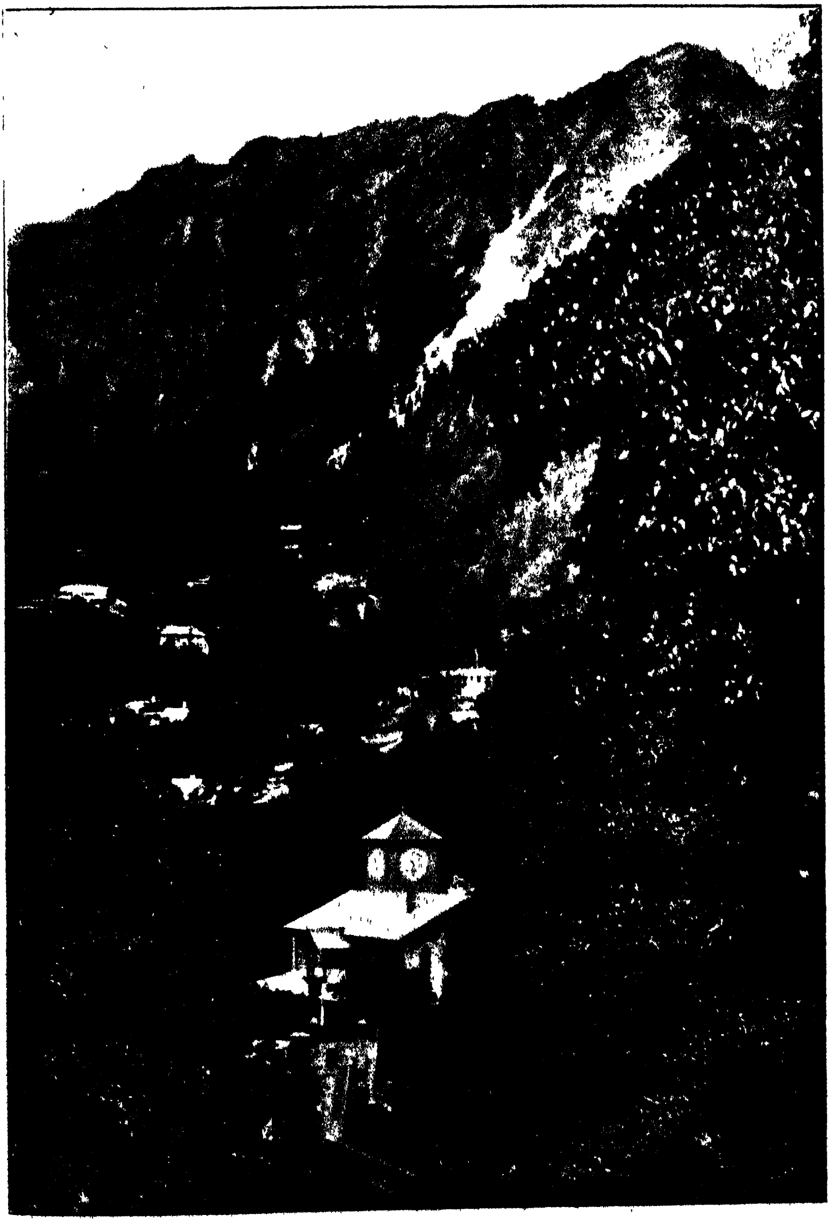
Mr. T. Rochford showed spotted forms of Odontoglossum crispum.

Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White), showed a grand specimen of Dendrobium × 'Euterpe.'

Captain Holford, Westonbirt (gr. Mr. A. Chapman), showed Sophro-Lælia × læta var. Orpetiana (S. grandiflora × L. pumila).

R. G. Thwaites, Esq., Streatham (gr. Mr. Black), sent Odontoglossum × Wilckeanum Thwaitesianum, with white, nearly unspotted flowers

R. Brooman-White, Esq. (gr. Mr. Cole), showed a fine Odontoglossum × Andersonianum.



NARCISSUS COMMITTEE.

NARCISSUS COMMITTEE, MARCH 12, 1901.

Mr. JOHN T. BENNETT-POË in the Chair, and eleven members present.

Award Recommended :—

Silver Flora Medal.

To Messrs. Barr, King Street, Covent Garden, for a group of Daffodils.

NARCISSUS COMMITTEE, MARCH 26, 1901.

Mr. JOHN T. BENNETT-POË in the Chair, and twelve members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Barr, for a group of Daffodils.
To Messrs. T. S. Ware, Feltham, for a group of Daffodils.

NARCISSUS COMMITTEE, APRIL 9, 1901.

Mr. JOHN T. BENNETT-POË in the Chair, and fourteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Barr, for a group of Daffodils.

Silver Flora Medal.

To Purnell Purnell, Esq., Streatham, for a group of Daffodils.

Silver Banksian Medal.

To Messrs. Peed, West Norwood, for a group of Daffodils.

Award of Merit.

To Daffodil 'Allen's Beauty' (votes, unanimous), from Miss Willmott, Great Warley. One of the earliest of the Bicolor Ajax. A plant of much interest, selected from wild Pyrenean N. variiformis by Mr. Jas. Allen, of Shepton Mallet. This and M. maximus are the only wild Narcissi, hitherto discovered, which can rank in size and form with our garden productions.

NARCISSUS COMMITTEE, APRIL 23, 1901.

Mr. JOHN T. BENNETT-POË in the Chair, and fifteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Barr, for a group of Daffodils, amongst which was the brilliant 'Lucifer.' (Fig. 153.)

Silver Flora Medal.

To Messrs. Bath, of Wisbech, for a group of Daffodils.

Bronze Banksian Medal.

To Messrs. Hogg & Robertson, Dublin, for a group of Daffodils.

First-class Certificate.

To Daffodil 'Robert Berkeley' ('Triandrus' × 'Minnie Hume') (votes,

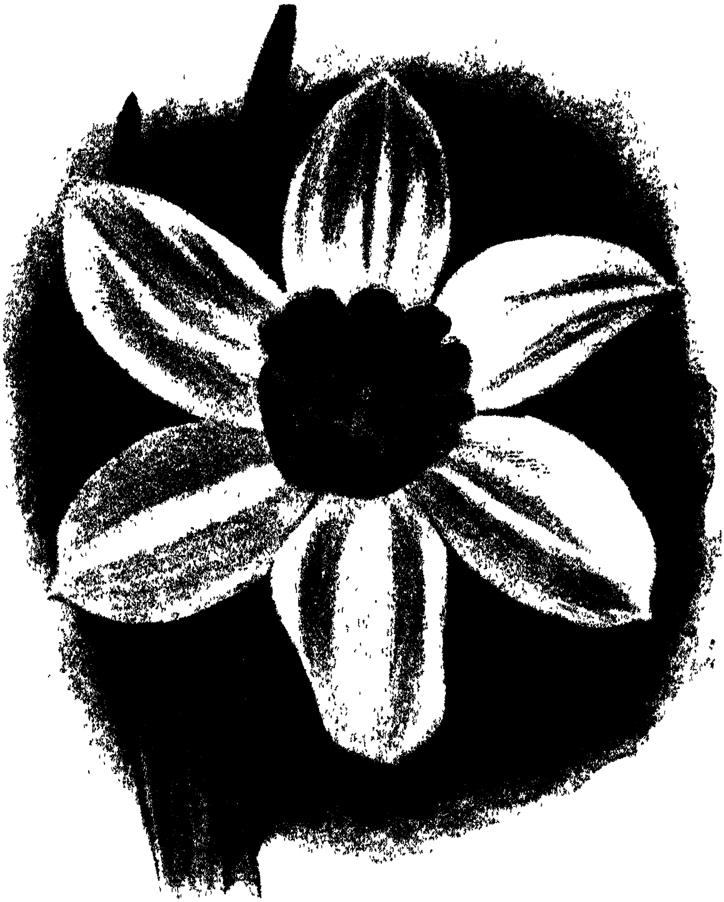


FIG. 153.—NARCISSUS INCOMPARABILIS 'LUCIFER.' (*Journal of Horticulture.*)

unanimous), from Miss Willmott. An ivory-white flower, retaining much of the form of 'Minnie Hume,' but greatly enlarged. (Fig. 154.)

To Daffodil 'Earl Grey' ('Triandrus' × 'Emperor') (votes, unanimous), from Miss Willmott. Cream-white perianth, long vase-shaped crown of pale creamy amber, the form and colouring quite suggestive of *triandrus*, but the size nearly that of Emperor. These two flowers, raised by Rev. G. H. Engleheart and grown to great perfection by Miss Willmott, are interesting examples of the size obtainable in crosses where one of the parents is a quite small plant.

To Daffodil 'General Roberts' (votes, unanimous), from Messrs. Barr. A very large, symmetrical, and massive Ajax, of the Emperor class.

Award of Merit.

To Daffodil 'Stella Superba' (votes, 9 for), from Mr. Walter Ware. An incomparabilis, with long white segments and clear yellow cup, not differing from Stella except in size, which is almost double. A useful market flower.

To Daffodil 'Master-at-Arms' (votes, 7 for, 6 against). A stoutly built bicolor incomparabilis, with short. broad crown.

FIG. 154.—NARCISSUS 'ROBERT BERKELEY.' (*Journal of Horticulture.*)

To Daffodil 'St. Cecilia' (votes, 10 for). A white Ajax of refined beauty, the segments broad and spreading; white; the crown long and well opened; ivory, with a pink tone within.

To Daffodil 'Florence' (votes, 10 for). A white Ajax, of good size; perianth ivory, twisted at the points; crown, ivory-maize.

To Daffodil 'Herrick' (votes, 10 for). A poeticus with deep red eye and substantial segments, from P. ornatus × P. poetarum. The last four flowers were from Rev. G. H. Engleheart, Appleshaw, Andover.

NARCISSUS COMMITTEE, MAY 7, 1901.

Mr. JOHN T. BENNETT-POË in the Chair, and eighteen members present.

Awards Recommended :—

First-class Certificate.

To Daffodil 'Moonbeam' (votes, unanimous), from Mr. R. Backhouse. A most lovely white incomparabilis or Leedsii, with firm, flat, circular perianth and short white cup; a perfect flower.

To Daffodil 'Elaine' (votes, unanimous), from Miss Willmott. Another very beautiful Leedsii. The perianth circular and of fine substance, the crown shallow and expanded, the whole flower of pale ivory. One of Mr. Engleheart's seedlings.

Award of Merit.

To Daffodil 'Dorothy Wemyss' (votes, unanimous), from Miss Willmott. An old variety of incomparabilis, raised by the late Mr. W. Backhouse, but hitherto without official award. A large flower, perianth cream-white, cup margined with orange-red.

To Daffodil 'Aftermath' (votes, unanimous). Perianth creamy white, crown edged fiery red; a large flat bloom.

To Daffodil 'Spenser' (votes, unanimous). A red-eyed poeticus of great solidity, a cross between *P. poetarum* and *P. recurvus*, and intermediate in season.

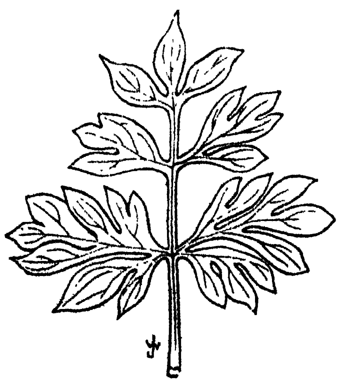
To Daffodil 'Day Star' (votes, unanimous). A very large, flat-built incomparabilis; ivory, with shallow, orange-flushed crown.

To Daffodil 'Sea Bird' (votes, unanimous). An incomparabilis of very large size, the ample segments are undulated; white; the cup deep and of a pure yellow.

To Daffodil 'Rear Guard' (votes, unanimous). A large late Nelsoni of remarkable solidity, the perianth broad and flat-set, the crown cylindrical; rich yellow.

To Daffodil 'Amber' (votes, unanimous). In the way of the old *Nelsoni major*, but with much broader, flatter segments. The long cylindrical crown is flushed with orange-amber.

The last six Narcissi came from Rev. G. H. Engleheart.



NOTICES TO FELLOWS.

AUGUST 1901.

FRUIT.

Grapes: Fellows can now obtain Black Hamburgh Grapes at 1*s.* 6*d.* to 1*s.* a lb., according to season and quality. Muscats from 3*s.* to 2*s.* a lb. Carriage will be charged extra as follows: 1 lb. 4*d.*, 2 lb. 6*d.*, 4 lb. 7*d.*, 5 lb. 8*d.* Apples and Pears, either Cooking or Dessert, may be ordered at prices according to season and quality. Orders for Fruit should be addressed *Superintendent, R.H.S. Gardens, Chiswick, W.*, and must be accompanied by Cheque or Postal Order to secure attention.

LETTERS.

All letters on *all* subjects (save above) should be addressed—The Secretary, R.H.S. Office, 117 Victoria Street, Westminster, S.W.

TELEGRAMS.

"**HORTENSIA, LONDON,**" is sufficient address for *telegrams.*

JOURNAL WANTED.

The Secretary would be very greatly obliged to any Fellows who have no further use for it, if they would send **Vol. XXV., Part 3, April 1901,** to him at 117 Victoria Street.

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS, &c.

Full instructions are contained in "Arrangements 1901," pages 25–32.

PLANTS CERTIFICATED.

A list of all the Plants, Fruits, Flowers, Vegetables, &c., certificated by the Society up to January 1, 1900, has been published, price 5*s.* The section devoted to Orchids, interleaved with lined foolscap and bound in cloth, can be obtained for Fellows by special order, price 5*s.*

The compilation of this volume has entailed an enormous amount of labour and research, and it is hoped that many Fellows will purchase a copy, not merely for the value of the information it contains, which, however is very great, but also in order to take a small share in the very considerable expense necessarily incurred in the publication of such a work. It can be obtained by Postal Order from the Society's Office, 117 Victoria Street, Westminster.

SHOW OF BRITISH-GROWN FRUIT.

Oct. 10, 11, 12, held at the Crystal Palace. Fellows are particularly requested to subscribe a small sum towards the Prizes, as £100 must be raised for the purpose. Send Cheques or Postal Orders to the Secretary, who will gratefully acknowledge them. Schedules of the Prizes, &c., can now be obtained from the Society's Office, 117 Victoria Street, S.W.

NEW FELLOWS.

The Centenary of the Society in March 1904 is fast approaching, and the Secretary is most anxious to double the number of Fellows before that eventful date. Will every Fellow assist him by sending in the name of at least one new Fellow during the present year?

LECTURES, &c.

Any Fellows willing to Lecture or to communicate Papers on interesting subjects are requested to communicate with the Secretary.

DRACÆNAS.

The Superintendent, R.H.S. Gardens, Chiswick, W., would be greatly obliged for any old plants of Dracænas, however old and long. Please shake out all the earth from the roots and send direct to Chiswick.

SUBSCRIPTIONS.

All Subscriptions fall due on January 1 of each year. To avoid the inconvenience of remembering this, Fellows can *compound* by the payment of one lump sum in lieu of all further annual payments; or they can, by applying to the Society, obtain a form of instruction to their bankers to pay for them every January 1. Fellows whose subscriptions remain unpaid are debarred from all the privileges of the Society; but their subscriptions are nevertheless recoverable at law, the Society being incorporated by Royal Charter. Fellows elected after July only pay a half Subscription for the current year.

DISTRIBUTION OF PLANTS, &c.

A list of plants to choose from was sent to every Fellow on January 31 (as it is every year), enclosed in the "*Report of the Council*" for the last year, and the ballot for order of distribution was made on March 1. All Fellows participate in the yearly distribution in the March *following* their election. No distribution can be made later in the year, though from the large number of Fellows to be served it is often the end of April before the March distribution can be completed.

MEETINGS AND SHOWS.

1901 (remaining), August 27; September 10, 24; October 10, 11, 12 (Crystal Palace); 15, 29; November 12, 26; December 17. **1902,** January 14, 28: the tickets of 1901 are available for these two Meetings in 1902. A reminder of every Show will be sent in the week preceding to any Fellow who will send to the R.H.S. Office 117 Victoria Street, S.W., a sufficient number of halfpenny cards *ready addressed* to himself.

CONFERENCE ON ROSES, 1902.

By the kind permission of the Earl of Ilchester it has been decided to hold a Conference on and Show of Roses in the grounds of Holland House, Kensington, probably in the last week in June. The Programme and Schedule will be published as soon as possible, but probably the only feature which will require special preparation will be a class for 24 Climbing Roses in, 12 varieties, shown in pots, so as to illustrate their habit, growth, and vigour.

AFFILIATED SOCIETIES.

Secretaries can now obtain on application a specimen copy of a new Card which the Council have prepared for the use of Affiliated Societies wishing to have a Card for Certificates, Commendations, &c. It can be used for Fruit or for Flowers, and is printed in two colours—art shades of deep blue and green. The Council are also preparing a special Medal for the use of Affiliated Societies, which will be ready for next year.

ADVERTISEMENTS.

Fellows are reminded that the more they can place their orders with those who advertise in the Society's Publications the more likely others are to advertise also, and in this way the Society may indirectly be benefited. An Index to the Advertisements will be found on page 84.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY.

THE TEMPLE SHOW, 1901.

MAY 22, 23 and 24.

JUDGES.

ORCHIDS.

Messrs. H. J. Chapman.
James Douglas, V.M.H.
J. Gurney Fowler.
Henry Little.

POT PLANTS IN BLOOM.
(Orchids and Roses excepted.)

Messrs. William Howe.
John Jennings.
J. McLeod.
Charles E. Shea.

FOLIAGE PLANTS, PALMS, &c.

Messrs. William Bain.
J. H. Fitt.
George Norman, V.M.H.
Owen Thomas, V.M.H.

CUT FLOWERS.

Messrs. Richard Dean, V.M.H.
Edwin Hill.
E. Molyneux, V.M.H.
George Paul, V.M.H.

ROSES.

Messrs. C. R. Fielder.
E. B. Lindsell.
Edward Mawley.
Rev. J. H. Pemberton.

FRUIT AND VEGETABLES.

Messrs. Edwin Beckett.
Thos. Challis.
W. Crump, V.M.H.
James Hudson, V.M.H.
James Smith, V.M.H.

AWARDS GIVEN BY THE COUNCIL AFTER CONSULTATION WITH THE JUDGES.

The order in which the names are entered under the several medals and cups has no reference whatever to merit, but is purely accidental.

The awards given on the recommendation of the Fruit, Floral, and Orchid Committees will be found under their respective reports.

Gold Medal.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for Orchids.

To Lord Aldenham, Aldenham House, Elstree (gr. Mr. Edwin Beckett), for Vegetables.

To the Guildford Hardy Plant Company, for Alpines.
To Messrs. J. Veitch & Sons, Ltd., Chelsea, for general exhibit.
To Messrs. T. S. Ware, Ltd., Feltham, for Begonias, &c.
To Messrs. W. Paul & Son, Waltham Cross, for Roses.

FIG. 237.—CAPTAIN HOLFORD'S HIPPEASTRUMS. (*Journal of Horticulture.*)

To Messrs. F. Sander & Co., St. Albans, for Orchids.
To Messrs. Fisher, Son & Sibray, Sheffield, for Foliage Plants, &c.

Hogg Memorial Medal.

To Messrs. T. Rivers & Son, Sawbridgeworth, for fruit trees.

Sherwood Silver Cup.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for Orchids.

Silver Cup.

To Lord Rothschild, Tring (gr. Mr. E. Hill), for Moss Roses.

To Lord Wantage, K.C.B., Lockinge Park, Wantage (gr. Mr. W. Fyfe), for fruit.

To Sir Jos. Pease, Bart., M.P., Guisboro' (gr. Mr. J. McIndoe), for fruit.

To Capt. Holford, C.I.E., Westonbirt, Tetbury (gr. Mr. A. Chapman), for Hippeastrums. (Fig. 237.)

Fig. 238.—Group of Sarracenias. (*The Garden.*)

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. G. Reynolds), for *Vanda teres.*

To R. I. Measures, Esq., Cambridge Lodge, Camberwell (gr. Mr. H. J. Chapman), for Insectivorous plants. (Fig. 238.)

To Mr. James Cypher, Cheltenham, for Orchids.

To Mr. George Mount, Canterbury, for Roses.

To Mr. Charles Turner, Slough, for Roses.

To Messrs. Geo. Bunyard & Co., Maidstone, for fruit.

To Messrs. Barr & Sons, Covent Garden, for general exhibit.

To Messrs. H. Cannell & Sons, Swanley, for Cacti (fig. 239) and general exhibit.

To Messrs. J. Carter & Co., High Holborn, for general exhibit.
To Messrs. R. & G. Cuthbert, Southgate, for Azaleas. (Fig. 240.)

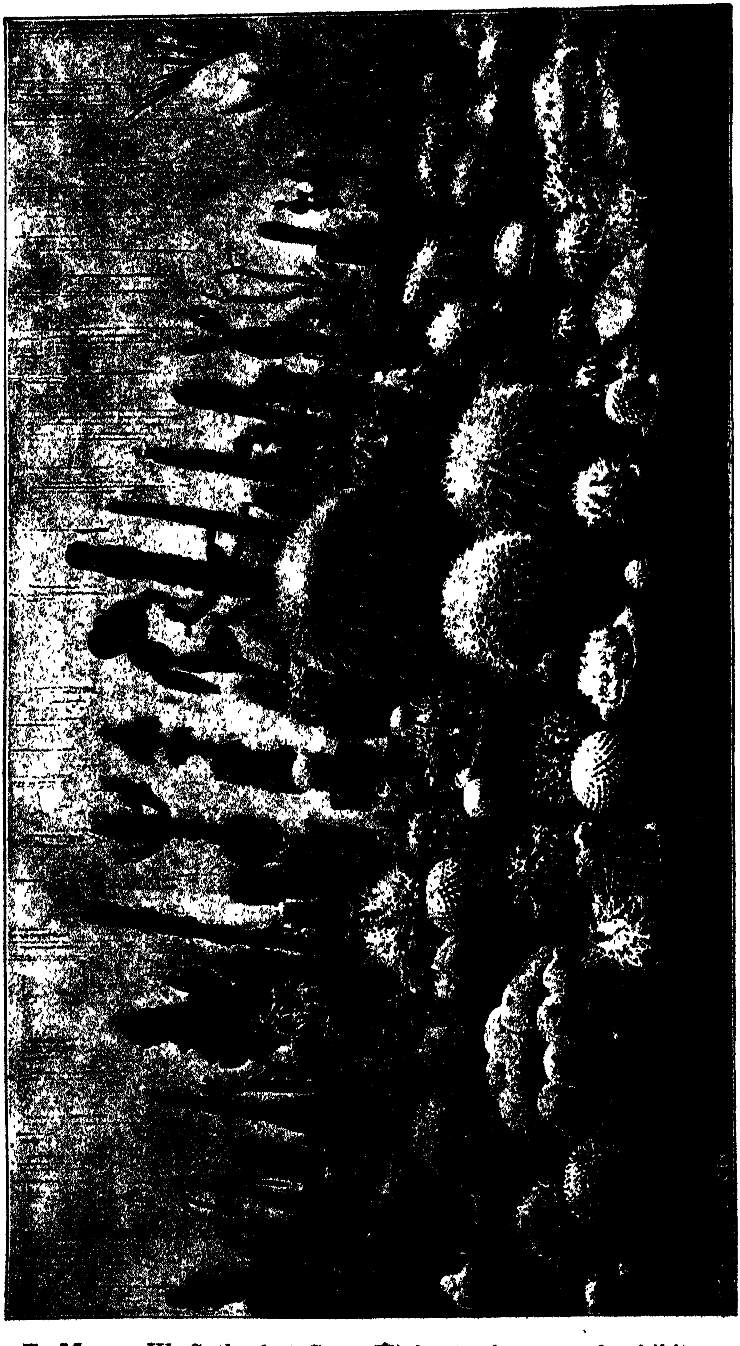


Fig. 239.—Cereus and Melon Cactus exhibited by Messrs. H. Cannell & Sons. (*Gardeners' Chronicle.*)

To Messrs. W. Cutbush & Sons, Highgate, for general exhibit.
To Messrs. H. Low & Co., Enfield, for Orchids.

To Messrs. Paul & Son, Cheshunt, for Roses.

To Messrs. R. Smith & Co., Worcester, for Clematis.

To Messrs. Sutton & Sons, Reading, for general exhibit.

To Mr. John Watkins, Hereford, for Apples.

Silver-gilt Flora Medal.

To Messrs. Stanley Ashton & Co., Southgate, for Orchids.

To Messrs. J. Cheal & Sons, Crawley, for hardy shrubs and herbaceous plants.

To Messrs. J. Laing & Sons, Forest Hill, for Begonias, Gloxinias, and Streptocarpus.

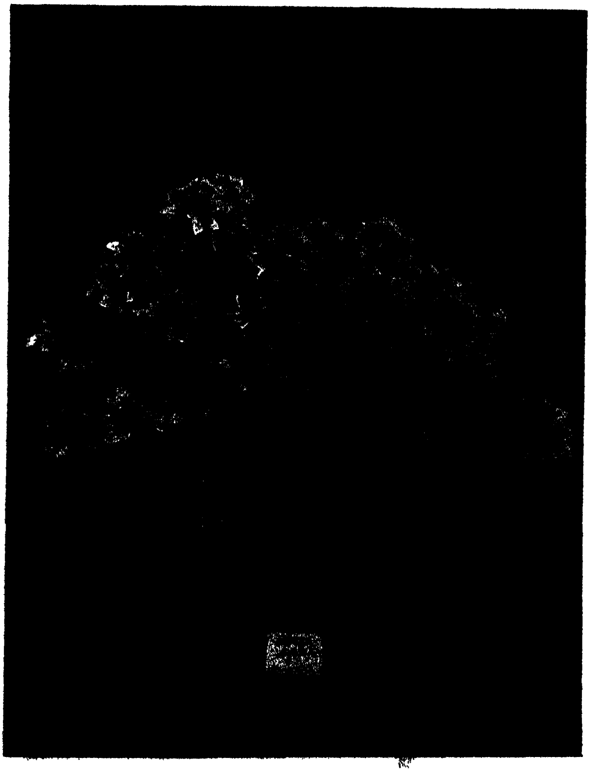


FIG. 240.—AZALEA MOLLIS, 'ALPHONSE LAVALLEE.' (*The Garden.*)

To Messrs. G. Jackman & Son, Woking, for Clematis (fig. 241) and hardy flowers.

To Messrs. T. Cripps & Son, Tunbridge Wells, for Japanese Maples.

To Messrs. J. Hill & Son, Lower Edmonton, for Ferns.

To Messrs. J. Peed & Son, West Norwood, for Caladiums, Begonias, &c.

To Messrs. R. Wallace & Co., Colchester, for Lilies and hardy flowers.

To Messrs. John Waterer & Sons, Bagshot, for Rhododendrons, Maples, &c.

Silver-gilt Knightian Medal.

To Alex. Henderson, Esq., M.P., Buscot Park, Faringdon (gr. Mr. W. L. Bastin), for fruit and vegetables.

Silver-gilt Banksian Medal.

To Mr. W. Rumsey, Waltham Cross, for Roses.
To Messrs. B. R. Cant & Sons, Colchester, for Roses.
To Messrs. W. Fromow & Sons, Chiswick, for Maples.
To Mrs. Ernest Hart, Totteridge, for Japanese trees. (Fig. 242.)
To Messrs. Hogg & Robertson, Dublin, for Tulips.
To Messrs. Storrie & Storrie, Dundee, for Auriculas.

FIG. 241.—CLEMATIS, 'PRINCESS OF WALES.' (*The Garden.*)

To Mr. Amos Perry, Winchmore Hill, for hardy plants.
To Messrs. Kelway & Son, Langport, for Pæonies.
To Messrs. B. S. Williams & Son, Holloway, for Orchids.

Silver Flora Medal.

To Messrs. Charlesworth & Co., Bradford, for Orchids.
To Monsieur Lucien Linden, Brussels, for Orchids.

To J. Leemann, Esq., Heaton-Mersey, for Orchids.
To Mr. W. B. Hartland, Cork, for Tulips.
To Mr. M. Prichard, Christchurch, Hants, for hardy flowers.
To Mr. John R. Box, West Wickham, for Calceolarias.
To Mr. A. J. A. Bruce, Chorlton-cum-Hardy, for Sarracenias.
To Messrs. Frank Cant & Co., for Roses.
To Messrs. Dobbie & Co., Rothesay, for Violas and Sweet Peas.
To Mr. S. Eida, 5 Conduit Street, W., for Japanese trees.
To Mr. T. Jannoch, Dersingham, Norfolk, for Lilies.
To Mr. H. J. Jones, Lewisham, for general exhibit.
To Mr. H. B. May, Upper Edmonton, for general exhibit.

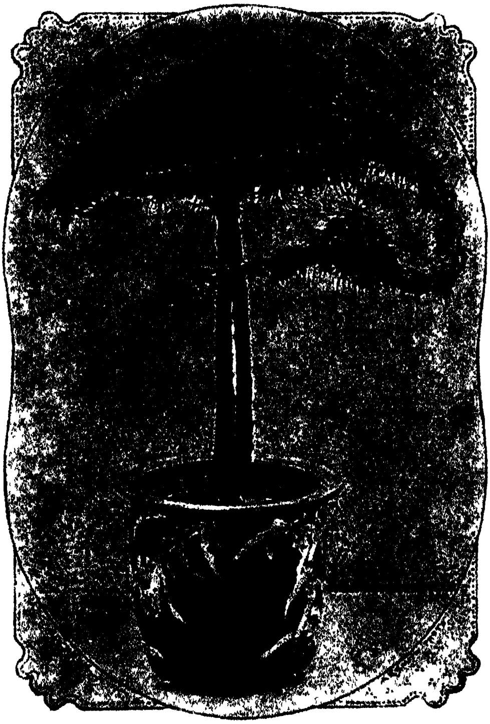


FIG. 242.—JAPANESE STORK EXHIBITED BY MRS. HART. (*Gardeners' Chronicle.*)

To Mr. John Russell, Richmond, for Japanese Trees (fig. 243) and general exhibit.

To Mr. J. J. Upton, Irlam, Manchester, for Gloxinias, Ferns, &c.

To Messrs. E. Webb & Sons, Stourbridge, for Gloxinias and Calceolarias.

Silver Knightian Medal.

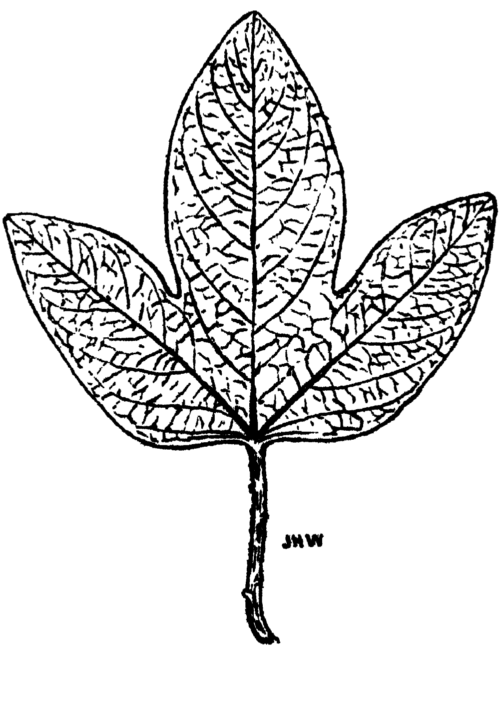
To Mr. W. Godfrey, Colchester, for Asparagus.
To Messrs. Laxton, Bros., Bedford, for Strawberries.
To the Horticultural College, Swanley, for vegetables.

Silver Banksian Medal.

To Mrs. Farrer, Ingleboro', for Alpines.
To Lord Hillingdon, Uxbridge, for Carnations.

FIG. 243.—GROUP OF DWARFED PLANTS EXHIBITED BY MR. J. RUSSELL. (*Gardeners' Chronicle.*)

To John Rutherford, Esq., M.P., Beardwood, Blackburn, for Orchids.
To Messrs. John Cowan & Co., Liverpool, for Orchids.
To Mr. F. Chapman, Colchester, for Asparagus.
To Mr. A. J. Harwood, Colchester, for Asparagus.
To Mr. Bodkin, Highgate, for Cacti.
To Mr. Leonard J. Ching, Enfield, for Ferns.
To Monsieur Florent Claes, Brussels, for Orchids.
To Mr. H. T. Dixson, Hailsham, for Carnations.
To Mr. K. Drost, Richmond, for Lilies.
To the Misses Hopkins, Knutsford, for Alpines.
To Mr. W. Iceton, Putney, for Lilies, &c.
To Messrs. Jones & Sons, Shrewsbury, for Irises and Sweet Peas.
To Mr. A. Knowles, Woking, for Daphnes.
To A. Meyes, Esq., Epsom, for Calceolarias.
To Mr. W. R. Newport, Uxbridge, for Lobelias.
To Mr. R. C. Notcutt, Woodbridge, for hardy flowers.
To Mr. G. W. Piper, Uckfield, for Roses.
To Purnell Purnell, Esq., Streatham, for Sempervivums.
To Messrs. W. H. Rogers, Southampton, for Rhododendrons.
To Mr. R. Sydenham, Birmingham, for Sweet Peas.
To Mr. W. Sydenham, Tamworth, for Pansies.
To Messrs. Watkins & Simpson, Exeter Street, Strand, for Lantanas.
To Messrs. A. W. Young & Co., Stevenage, for general exhibit.



GENERAL MEETING.

JUNE 4, 1901.

Mr. HARRY J. VEITCH, F.L.S., in the Chair.

Fellows elected (132).—Miss Madeline Agar, Arthur J. Ashbee, Miss M. A. Austen, Herbert F. Barclay, Miss Josephine Barclay, Mrs. T. H. Barnard, E. J. Batchelor, Hugh Hill Bell, Thomas Blackmore, James Bone, George Boyes, C. Atherton Brown, John Butler, Edward J. Caley, J. P., W. J. Caparne, C. E. Pole-Carew, Mrs. C. E. Pole-Carew, Frederic H. Carter, J. Russell Chibnall, H. I. Chinnery, A. Clark, Charles James Clark, G. Clark, Miss E. G. Clark, W. H. Cliffen, Dow. Marchioness Conyngham, Dr. Marriott Cooke, Walter H. Cozens, J. T. Creir, Mrs. J. T. Currie, Mrs. L. Dalrymple, Mrs. Davies, Mrs. G. Davies, S. Summers Drew, William Dunn, Mrs. E. Lloyd Edwards, Arthur Fletcher, J. J. Foster, Edmund Furse, Miss Lucy A. Gandy, James Glasheen, Mrs. Godsal, James Goode, B. S. Gott, M.A., F.C.S., Frederick Greenfield, Captain D. Griffith, A. E. Halloway, E. J. Halsey, Duchess of Hamilton, Francis M. Hare, D. Harris, A. S. Harrison, Mrs. M. T. H. Harvey, Alfred Hicks, Alfred R. Holland, T. W. Holland, Frederick R. Howell, Mrs. L. Hume, Gerald P. Hutchinson, Mrs. Meynell Ingram, E. S. Insull, Lord Iveagh, A. Marshall Jay, F. P. Johnson, J. August Kurtz, Samuel H. Lane, L. P. De Langhe-Vervaene (Brussels), Joseph C. Mabey, Miss McCarthy, Mrs. J. Mason, Comte de Mauny-Talvande, Mrs. D. H. Mavor, Miss B. Meinertzhagen, A. Millar, Mrs. Monsell, Mrs. A. Hickman Morgan, Victor J. Moulder, Hon. Lady Neeld, William R. Newport, Mrs. Newton, Miss Isabel G. Niven, William Nunn, Mrs. J. F. Ogilvy, Rev. F. G. Oliphant, Countess of Onslow, William Pain, R. S. Paul, Mrs. Peacocke, Mrs. Pickering Phipps, Mrs. Plimmer, F. H. Pollexfen, William Porteous, A. E. Price, W. H. St. Quintin, Lieut.-Col. W. J. F. Ramsden, Mrs. Reid, Herbert Wm. Rendell, Thomas Roberts, Henry Robson, Charles D. Rose, Charles D. Rudd, R. Sankey, Jonathan F. Sargeant, Charles Schneider, Miss E. M. L. Scull, C. Sewell, C. Shattock, Mrs. L. de L. Simonds, F. Sleight, Mrs. E. Lindsay Smith, Lancelot H. Smith, Mrs. Lyle Smyth, G. Stanley, Arthur H. Stevens, Mrs. Stevens, G. H. Style, W. E. Taylor, Ernest E. Thomas, W. D. Thomson, F. J. Tickner, H. A. Trower, Mrs. H. A. Trower, Robert Tunstill, Miss I. S. Turner, Mrs. Henry L. Warde, Mrs. Westmacott, Alfred W. White, Henry W. White, J. H. Wiggington, Mrs. Smyth Windham, A. Leslie Wright, Hon. F. G. Wynn.

Associates (2).—John N. Forbes, Henry F. Robson.

Society affiliated (1).—Bradford Horticultural Society.

A lecture on "Recent Discoveries in Heredity" was given by Mr. W. Bateson, M.A., F.R.S.

GENERAL MEETING.

JUNE 18, 1901.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

Fellows elected (36).—John Balfour, Sir Francis Tress Barry, Bart., M.P., C. A. Bingel, Mrs. Brocklehurst, Countess of Buckinghamshire, George M. Burlinson (New Zealand), Mrs. Clayton, B. Cooper, L.R.C.P., Mrs. William Coryton, Lady Mary Dashwood, Mrs. Dawkins, Charles W. Early, E. C. Engelbach, Floyd Ferris (United States), Mrs. R. Collingwood Foster, Miss Mary Goring, Francis Edward Guilford, W. F. Gullick, W. C. Gunn, Robert J. Hamill, Mrs. Henry, Mrs. James Hope, William Jackson, Sir William Jaffray, Bart., Eugene M. Lawrence, Norman Leete, R. J. Lesslie, G. E. Philcox, Arthur Pontifex, Samuel Pope, Mrs. Edward Rose, William Salter, Bruno Schröder, Mrs. R. C. Smith, Mrs. Edward Stern, George B. Windeler.

A lecture on "Gardening in the London Parks" was given by Col. M. J. Wheatley, C.B., R.E., Bailiff of the Royal Parks. (See p. 282.)

GENERAL MEETING.

JULY 2, 1901.

Rev. W. WILKS, M.A., in the Chair.

Fellows elected (32).—C. H. Babington, Drew Bear, Robert Berkeley, Lady Margaret Bickersteth, Mrs. R. Bingham, Lady Margaret Boscawen, Mrs. Cleeves, Mrs. Coysh, Alfred Cull, Oscar W. D'Alcorn, Thomas R. Dallmeyer, F.R.A.S., Charles Dendy, Charles Dixon, Bernard Dunning, Thomas Gibbons, Mrs. L. Glass, Edric Haig, Laurence Hardy, M.P., Mrs. J. B. Heath, Robert A. Laing, Henry B. Legge, Miss Florence L. Newbury, Arthur H. Newman, Miss Roddam, Surg.-Col. A. Sanderson (Jersey), John Scaramanga, Captain A. G. Shortt, R.A., Robert C. Stevenson, Lady Tennant, S. J. Waring, jun., Lady Whitehead, Mrs. A. Wybourn.

A lecture on "Mimetic Resemblances among Plants—a Proof of the Inheritance of Acquired Characters," was given by the Rev. Prof. G. Henslow, M.A., V.M.H. (See p. 327.)

GENERAL MEETING.

JULY 16, 1901.

CHISWICK GARDENS.

Mr. H. J. ELWES, F.R.S., V.M.H., in the Chair.

Fellows elected (31).—Miss J. Arden, A. A. Armfield, William F. Burleigh, Mrs. Rhodes Cobb, J. Curtis, Mrs. R. C. Franks, Thomas S. Gooch, Mrs. Charles Leveson Gower, Hon. Mrs. Gretton, Miss L. Guilford, Arthur Harris, T. S. Hillas-Drake, C. A. Johansen, Mrs. Ernest

Johnson, Chas. H. Lamb, Arthur H. Leslie Melville, J.P., Rev. Newton Mant, Capel Morris, Miss C. A. Nicholetts, George Nicol, Henry Pearks, Miss Pickford, Mrs. Harcourt Roe, Frederick Sanders, John S. Satterthwaite, Mrs. I. Seligman, Mrs. Assheton Smith, Mrs. H. D. Terry, Fred Tinsley, Edward A. D. White, Mrs. Yerburgh.

Conference on "Lilies" opened at 2 P.M. (See p. 382.)

GENERAL MEETING.

JULY 30, 1901.

Rev. W. WILKS, M.A., in the Chair.

Fellows elected (39).—James C. Austin, Harry Barker, George H. Clack, Harold S. Cluse, Hippolyte Cochonot (France), Lady Cranworth, Robert I. Critchley, J.P., Miss Anne Dawson, Mrs. Dunn, John H. Geall, Mrs. Gibb, Clement Godson, M.D., Mrs. Gunn, Rt. Hon. R. W. Hanbury, M.P., Frederick J. Hanbury, F.L.S., Howard Houlder, Mrs. E. T. Leighton, A. L. Lewis, John T. Lunn, George Maples, Marc Micheli (Genève), A. G. Neville, F. Norris, Thomas Norris, Lady Pollock, Thomas W. Quayle, W. Ramsden, Miss Rawson, Hon. N. Charles Rothschild, H. Sewell (Australia), Mrs. P. V. Sharman, James S. Sherratt, Geoffrey Yorke Smallwood, Thomas W. Sorby, Bertram Tatham, W. E. Wallace, Miss Ella M. Watkins, John Williams, F. Hue Williams.

Society affiliated (1).—Wakefield Paxton Horticultural Society.

Associate (1).—James Cartledge.

A lecture on "Some of the Plants Exhibited" was given by the Rev. Prof. G. Henslow, M.A., V.M.H. (See p. 455.)

GENERAL MEETING.

AUGUST 13, 1901.

Mr. GEORGE BUNYARD, V.M.H., in the Chair.

Fellows elected (18).—Mrs. Caldecott, Frederick Cox, Bernard M. Drake, C. Engelmann, Alexander S. Galt, William F. Gunn, W. B. Hartland, William Hicks, F. W. Humphreys, William H. Johnson, Alick E. Mee, Douglas J. Mounsey, Gilbert Purvis, F.R.C.I., Miss Phœbe Storr, Joseph H. Straker, William S. Thomson, Miss Tring, Henry Turner.

A lecture on "Tender Plants for Outdoor Gardening" was given by Mr. William Townsend. (See p. 458.)

GENERAL MEETING.

AUGUST 27, 1901.

Mr. A. H. PEARSON, F.R.H.S., in the Chair.

Fellows elected (22).—Miss Behrens, Mrs. Robert Beresford, G. Bethell, H. S. H. Bickham, M. L. Evans, Edward Freshfield, George

St. Pierre Harris, Edward Holland, Henry T. Hutton, T. Borland Kendall, J. Lion, Mrs. Montefiore, Mrs. Douglas Murray, Mrs. Newman, Walter Peel, George Pyne, Mrs. Rapier, John Surman, C. H. Walton, H. Barlow Webb, Arthur Wilson, Charles Wilson.

Society affiliated (1).—The Horticultural Society of Jersey.

A lecture on "Garden Manures" was given by Mr. F. J. Baker, A.R.C.S. (See p. 462.)

GENERAL MEETING.

SEPTEMBER 10, 1901.

Mr. JOHN T. BENNETT-POË, F.R.H.S., in the Chair.

Fellows elected (11).—Mrs. T. A. Argles, Mrs. E. H. Bayldon, Mrs. E. Bolton, Edwin Edward, Mrs. J. A. Horsford, M. I. McLaughlin (Australia), W. S. Millard (India), J. L. Pickard, J. Maitland Shaw, E. E. St. Quinton, Julien S. Tripplin.

A lecture on "The Origin and Development of the Cactus Dahlia" was given by Mr. C. G. Wyatt. (See p. 467.)

GENERAL MEETING.

SEPTEMBER 24, 1901.

Dr. MAXWELL T. MASTERS, F.R.S., in the Chair.

Fellows elected (20).—James B. Blackmore, Walter J. Blake, Mrs. Glywn Bolitho, General E. F. Chapman, Mrs. M. Fox, Mrs. C. Grote-Joyce, Mrs. E. V. Lucas, J. B. Marchant, Mrs. E. W. Oliver, T. Pinniger, John Scanes, Robert Smith, Rayner Storr, James Stredwick, Charles W. Sutton, George H. Towndrow, Frederic Turner, R. Mansfield Wakeley, Rev. C. T. Wickham, Charles E. Wilkins.

A lecture on "Roses for Autumn Blooms" was given by Mr. Arthur Wm. Paul. (See p. 478.)

SCIENTIFIC COMMITTEE.

June 4, 1901.

Dr. M. T. Masters, F.R.S., in the Chair, with eighteen members present and Sir George King, K.C.I.E., F.R.S., V.M.H., visitor.

Before commencing the usual business, the Chairman said he had a very pleasant duty to perform, which was, on behalf of the Council of the Society, to present the visitor, Sir George King, with the Victoria Medal of Honour. Sir George King expressed his great pleasure in receiving it, but considered himself as not worthy of that honour, a sentiment unanimously disavowed by all the members present.

Loss of Reserve Matter in Pruning Vines.—Referring to his note on this subject on page xxii Mr. Sharpe writes:—"My vines are growing in very poor soil. The first six inches is a mixture of coal ashes and sand, and below this some fifty feet of green sand; they have no artificial heat; and the supply of water is deficient. The age of the canes is from seven to ten years. Under these circumstances the preservation of reserve matter is all important, and I am able to report quite considerable improvement, viz. double the crop. 'Shanking' also is practically nil, only some dozen berries at most. When the vines started last spring the show of fruit was great, small buds developing all round the spurs, some of them proving fruit bunches only. I have continued through the past summer the treatment reported on page xxii, and purpose trying a (to me) new method of pruning next winter, on which I hope to report later on."

Schinus Molle with Galls.—Mr. Robert Newstead reported as follows upon the specimens sent by Dr. Bonavia from San Remo:—"The insects upon the shoot are a species of adult ♀ *Ceroplastes*, I think *C. rusci*, Linn., which is the only known Palæarctic species of the genus. The insect is one of the most beautiful of the Coccidæ."

Cherry Fruits and Caterpillars.—Specimens sent from the Chiswick Gardens showed some 50 per cent. of the fruits attacked. The insect, being sheltered within the calyx of the blossom, is protected from insecticides. Mr. Saunders reported as follows upon them:—"The young Cherries from the Society's garden at Chiswick were attacked by the caterpillars of a small moth, *Argyresthia ephippella*, one of the Tineina. As to the destruction of this insect, where it is possible, cutting off and immediately burning the infested bunches of blossom is a very effective method. I cannot find any account of the life-history of this insect, and am therefore uncertain in what condition, or where, it passes the winter. If it be, either in the egg or chrysalis state, attached to the bark of the stem or branches, a good remedy would be spraying with a caustic alkali wash, some time after the leaves have fallen, and before the buds show any signs of opening in the spring. If the chrysalides be formed in the ground, a good dressing of lime applied to the surface early in the spring would probably prevent the moths from reaching the open air. Spraying

the fruit would not be of any use, as the insecticide would not reach the caterpillar inside."

Raspberry Buds attacked by Caterpillars.—Mr. A. Gaut, of the Yorkshire College, Leeds, sent the following communication :—"Enclosed you will find some Raspberry-buds containing caterpillars of the Raspberry stem-bud moth (fig. 244)—*Lampronia rubiella*, Bjerk—which the Committee would possibly like to see and notice. In and around Garforth, about seven miles east of Leeds, upwards of 100 acres of Raspberries are grown for market purposes, and in some years this attack is a very serious one, as was the case last year, 1900. I visited the grounds then during the months of April, May, and June, and noticed the caterpillars, pupæ, and little moths in immense quantities, in some of the Raspberry grounds the canes having an appearance as if they had been very much injured by frost. This entailed great loss to the growers. On April 20 I took a walk through several of the grounds; noticing large quantities of the little scarlet caterpillars crawling up the stems, and very many within the

FIG. 244.—LAMPRONIA RUBIELLA. (*Gardeners' Chronicle.*)

buds, I naturally expected a very serious attack again this year; but fortunately, owing to the warm weather we have experienced during the past week, the young buds and shoots have made such rapid progress that they have grown away from the attack, and although the caterpillars are still present in immense quantities, the crop will not be much affected. I notice that it is in cold, late springs we get the worst attacks. Some of the more intelligent growers do not suffer so much, as they take the precaution to mulch the ground with soil containing some insecticide, or dress the ground about the stools with soot or lime during the winter months; and it is curious that those who follow the old practice of digging amongst the canes in winter also escape fairly well. I am doing all I can in the way of advice, but it is difficult to get many to follow it; and where there are so many growers it is impossible to get them all to combat this attack at one and the same time, as ought to be the case."

Fungus on Wood.—Mrs. Floyer sent a specimen of an orange-coloured

wood-like mycelium, observing that "it grows on the wooden posts put to protect visitors in the interior of Poole's Cavern, Buxton. It occurs many yards inside, where no light except that of an occasional gas-jet can reach it." Dr. M. C. Cooke reported upon it as follows:—"The substance you send has long been known and noted under the name of *Ozonium aureum*, and classed with fungi; but it is only an incomplete or imperfect stage, analogous to *Rhizomorpha*. It is supposed to represent the mycelium of some one or more of the woody *Polypori*, possibly of *Fomes fomentarius*; this is, however, of small importance. It is an incomplete fungus, and will attack living trees, especially about the roots, and ultimately kill them."

Pelargonium, Dissociation of Colours in.—Rev. W. Wilks exhibited a truss from a plant which normally bears bright red-crimson flowers; but it had three blossoms of a pale pink-mauve tint, probably a reversion to an ancestral parent, such as *P. grandiflorum*, one of the original sources of the modern composite hybrid fancy Pelargoniums.

Podisoma on Juniper.—A branch bearing this fungus was received from Mr. W. H. Divers, Belvoir Castle. It is dimorphic, and produces the other form, known as *Ræstelia lacerata*, on the Hawthorn.

Rose-leaf, Discoloured.—Mr. Saunders showed leaves from a 'Marie Van Houtte' Rose growing at Oxford. It was planted in 1899, and did fairly well in 1900; but this year all the leaves are variegated, much resembling those of the Japanese Honeysuckle. It was difficult to pronounce as to the cause, but defective root action or something deleterious in the soil was suggested as likely to produce it.

Rose-stem Gall.—Mr. Saunders showed a stem of *Rosa rugosa* with a gall-like growth formed just above the level of the earth. The plant was one in a Rose-hedge composed of *R. rugosa* and 'Aimée Vibert.' Several of the plants are affected in the same way. It appears to resemble a bacterial disease that attacks Raspberry-canes in the United States, known as "root or crown gall," and is by some attributed to frost. The Rose was grown at Micheldever, Hampshire. Mr. Worsdell undertook to examine it.

Cephalotaxus Fortunei malformed.—Mr. Worsdell exhibited drawings of proliferous conditions of the female flowers of this tree. These form really an inflorescence of bracts with two ovules, the latter being another shoot. Both the main axis and the floral axis were proliferous. The question arose as to whether this was the result of an impediment to the circulation through strangulation, to which the tree was subjected, or to non-pollination.

Miltonia vexillaria.—Mr. Chapman showed a fine flowering plant, remarkable for having the lateral petals marked like the labellum. It had exhibited this peculiarity for eight years in succession, and plants raised by offsets from it bore the same abnormal flowers.

Tulip malformed.—Mr. O'Brien exhibited a Parrot Tulip in which the bracts and outer perianth leaves were partly green and partly yellow, exhibiting a not uncommon struggle between the "vegetative" and "reproductive" energies. Mr. Saunders exhibited a Tulip showing a bulbil in the axil of a leaf on the flower stem.

Aroid with flies.—Mr. Bowles exhibited a large-spathed Aroid, the

contracted part of the spathe being full of dead flies (*Lucilia*). These had previously laid eggs, the grubs of which had lived in the decaying mass. It was somewhat difficult to explain how cross-fertilisation could be secured, and how insects born within the spathe could escape.

Peach-leaves Diseased.—Samples were received from Mr. Gurney Fowler, which Dr. M. C. Cooke undertook to examine.

Crinum hybrid.—Mr. Worsley showed a fine bloom of *C. scabrum* × *C. Moorei* with a rose-coloured perianth.

Tomato-leaves Proliferous.—Dr. Bonavia sent some examples of this not uncommon peculiarity. It was the variety 'Orchard's No. 1.' Dr. Bonavia regards the leaf as a modified branch, but the anatomical structure of the petiole is not that of a stem, but of the usual kind in petioles, having a horseshoe-like section of the fibro-vascular bundles, with two extra cords above on either side of the superior groove. The leaves had been shortened, and the abnormal buds grew out as a consequence from the axils of the leaflets. The infloresence appears to terminate in a leaf with an axillary bud, but this latter is really the terminal bud being displaced by the vigour of the leaf. Mons. P. Duchartre was the first to describe proliferous Tomatos. It occurred particularly in the true species, *Lycopersicum cerasiforme*, Dunal, less so in *L. pyriforme*, Dunal, and only in the hybrid *L. esculentum* when the leaves had been cut. Duchartre says the proliferous state was practically habitual in the yellow variety of the first-named species. The new bud arises from the axil of the leaflet, and a vascular connection is made with the upper end of the "horseshoe"; the cords are very sinuous at first, but soon form a perfect cylinder of an oval form in section, which then runs up the stem of the new bud.

Scientific Committee, June 18, 1901.

Dr. M. T. Masters, F.R.S., in the Chair, with fifteen members present, and Monsieur H. Correvon, Geneva, visitor.

Abies and Picea hybrids.—Dr. Masters exhibited from Monsieur Moser, of Versailles, four specimens, all different, the result of a cross between *A. Pinsapo* and *A. Nordmanniana*, and one specimen between *Picea ajanensis* and *P. nigra* var. *Doumeti.* This is remarkable for having the stomata on the upper side of the leaf, in correlation with the habit of the leaves lying horizontally with the upper surfaces downwards.

Cornflowers Diseased.—Mr. J. Laws sent specimens of *Centurea Cyanus* badly afflicted with "rust." Dr. Cooke reported upon it as follows:—"Plants of *Centaurea Cyanus*, covered with rusty spots on leaves and stems, were sent to the committee in a deplorable condition. This fungus, as far as present experience goes, is the same as that which attacks Chrysanthemums, and is called *Uredo Hieracii.* Plants in the condition sent should at once be rooted up and burnt. It will be well understood how dangerous it would be to have such a pest in the neighbourhood of Chrysanthemums, and probably others of the Compositæ, to say nothing of the Cornflowers themselves."

Potamogeton crispus.—Mr. Mark Webster described a pond infested

by this Pondweed. Cutting it down with a scythe, as often practised, only tends to propagate it still more. Monsieur Correvon observed that the only method, as adopted in Geneva, to keep the Water Thyme, *Elodea canadensis*, in check, was to clear out the pond once in three years. Other members suggested the introduction of water snails, especially *Lymnæa stagnalis*, and species of *Planorbis*.

Dendrobium Dimerous.—Mr. R. Young, of Liverpool, sent a flower having only two petals and two sepals, a not uncommon form.

British Orchids.—Mr. Bowles sent specimens of *Liparis Loeselii*, as well as both white and pale varieties of *Orchis latifolia* var. *incarnata*, from Horning, Wroxham. The former is interesting, as showing the commencement of the inversion of the lip in Orchids generally. This petal is in *Liparis* at first erect and posterior, but then lies flat, so that an insect readily stands upon it. In *Ophrys* the lip becomes pseudo-anterior by the flower simply bending over to the opposite side of the plant. In other Orchids the false anterior position is due to a twist of the pedicel, as in *Listera*, or else of the inferior ovary, as in *Orchis*. Mr. Bowles observed that the "*Liparis* is still plentiful at Horning, but owing to its dwarf stature, and the boggy nature of the ground in which it grows, it is easily overlooked. It thrives wonderfully well in an artificial bog made of jadoo in my rock garden. The white form of *O. latifolia* is very abundant, large patches sometimes occurring. *Listera ovata* (Twayblade) and *Ophioglossum vulgatum* also occur in a 'dancing bog,' and grow very large. I also send an albino *Pedicularis palustris*."

Tomatos attacked by fungus.—Mr. G. E. Day sent specimens diseased with *Macrosporium Tomato*. It was in the young state. The best remedy is spraying with Bordeaux mixture in an early stage of growth.

Parasitic Disease.—Touching the note on this subject on p. 197, Mr. Sharpe, of Westbury, writes: —"It is very helpful to have so great an authority as Dr. Sorauer. Parasites we have in abundance, and useful recipes for combating them. But, speaking from experience, one ventures to emphasize the importance of fortifying our plants against disease. Several years' battle with Tomato *Cladosporium* led me to this conclusion, which was subsequently strengthened by reading of '*Phagocytosis*.' When *Cladosporium* first made its appearance with me, the posting of affected leaves to various gardening papers brought no help. No help is sometimes good: one is compelled to try to find answers for oneself to such questions as, What conditions favour the parasite? and, What the host? And the outcome is an endeavour towards providing ideal climatic conditions for the host, with results thus far certainly good, but immunity not absolutely secured. Physiology, observation, and thought have proved useful, and after several years of an ever-increasing tendency to immunity the plants have freedom now, by means of free ventilation and plenty of phosphates and lime."

Asplenium Trichomanes, var.—Mr. C. T. Druery showed a plant of this Fern which had several fronds partially bipinnate. It was found in Wales. It was interesting as exemplifying an attempt of a normally pinnate species to assume the form of an exotic one. The variety so far did not approach the incised section, which varies on quite different lines.

Papaver Rhœas, var.—Mr. C. T. Druery also showed flowers of a

Poppy having an intense crimson colour, a native of Asia Minor. They were raised from seed brought from Smyrna, and have been growing for two years spontaneously in a garden at Acton. Each petal had a small black spot or line at the base.

Peach blister.—Dr. Bonavia sent leaves badly attacked by this common disease, *Exoascus deformans.*

Apple Bark, threads on.—Mr. F. Marsh Read sent a piece of Apple bark covered with twisted golden threads. He observes that "the main stem for about 6 feet from the soil is 'ribboned' with it." Dr. Cooke reports upon it as follows:—"Portions of the bark of living Apple-trees were sent for information. The bark was covered with long yellow filaments, thin as a hair, and much contorted and interwoven together, presenting a very singular and conspicuous appearance. Upon examination a number of compound cells may be seen in the bark, each with an external orifice, from which the golden tendrils protrude. These filaments are composed of myriads of very minute conidia or spore-like bodies, adhering to each other as they exude. They are at first soft and flexile, but soon, on becoming dry, the filaments are brittle and horny, or hair-like, variously twisted and contorted, and little thicker than a human hair. The number of very minute spore-like bodies composing each filament must be enormous (each 5 micromillemetres long, and slightly curved). The fungus has long been well known on Pomaceous trees, but we have not met with it before upon living bark. It is known as *Cytospora carphosperma.* Later on, the same pustules are occupied by a Sphæriaceous fungus, which is believed to be the ultimate development of this dimorphous organism, and in this condition each pustule consists of a few flask-like conceptacles or perithecia with rather long converging necks. These perithecia enclose numerous delicate cylindrical sacs, or asci, each containing eight sausage-shaped sporidia (16 to 18 by 3 to 4 mm.), nearly of the same shape as the minute conidia, but many times larger, in which condition the fungus is known as *Valsa ambiens,* and has been found not only on Pear and Apple, but also on Maple, Beech, Hazel, Alder, Plum and Cherry, Elm, Oak, Hawthorn, Poplar, Chestnut, Lime, and even on Rose. Hence it is widely diffused and well known. It would be a dangerous enemy if once it became established as a parasite on living fruit-trees. The mature condition may be found late in the autumn, in the winter, and in the early spring."

'Gloire de Dijon' Rose, Proliferous.—Mr. Chapman exhibited flowers having their centres occupied by a green tuft of leaves, &c. He observes that, of about two dozen plants, the whole of the flowers this year and for several years previously have developed this peculiarity.

Birch-tree Bark Diseased.—Mr. A. Walker, of Needham Market, sent some specimens, which Mr. Saunders undertook to examine.

Cattleya Mendeli Malformed.—Flowers were sent by Sir Trevor Lawrence, as well as of *Odontoglossum crispum,* which Dr. Masters undertook to report upon.

Thistle Fasciated.—Mr. Houston showed an abnormally large specimen of this common monstrosity.

SCIENTIFIC COMMITTEE, JULY 2, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and thirteen members present.

Orchids, Malformed.—Dr. Masters reported on the flowers sent to the last meeting. He found the *Cattleya* to be dimerous, and the *Odontoglossum* to have five perfect stamens, the other parts being variously twisted and deformed.

Hart's-tongue, abnormal form.—Mr. C. T. Druery exhibited a plant with the fronds variously modified, being subhastate, emarginate, subpinnate in places, and much crested. It was a seedling of doubtful origin; but a similar plant had been found wild many years ago.

Aristolochia trilobata.—Mr. Odell showed flowering shoots of this species, remarkable for the form of the flower, in that the calyx closely resembled a pitcher of *Nepenthes*, having a lid provided with a long pendulous streamer.

Cheiranthus alpinus, pods proliferous.—Mr. Odell showed specimens of this not uncommon monstrosity in certain Cruciferæ. The pods were swollen at one place, within which was a double flower having several crumpled yellow petals and abortive stamens in the place of an ovule.

Silene and Anthyllis.—Mr. Holmes found that the specimens sent to the last meeting proved to be *S. hirsuta*, and a variety of *A. Vulneraria*.

Campanula, fasciated.—Mr. Holmes exhibited a large terminal flower of the common Canterbury Bell. It consisted of a "multifold" flower of numerous parts; also a flower of *Paris quadrifolia*, with six leaves to the whorl, but having the usual 4-merous perianth.

Plymouth Strawberry.—Mr. Holmes brought interesting specimens of the "Plymouth Strawberry," which he has had growing for ten years. It is remarkable for having a foliaceous flower, the petals and stamens being represented by numerous small leaves, as in the Green Rose and Alpine Strawberry; while each carpel on the receptacle consists of a three-pointed leaf, or rather petiole, rolled up upon itself. There is no trace of an ovule within it.

Beech with palmately-nerved leaves.—Mr. Holmes also showed specimens of this peculiarity, apparently due to some insect attack. Mr. Saunders undertook to examine it.

Proliferous Cones of Cryptomeria.—Mr. Worsdell brought specimens of this monstrosity, which Dr. Masters observed was not an uncommon production in that particular tree.

Lily Fungi.—Dr. Rendle showed stems badly attacked by a fungus. Dr. M. C. Cooke reports as follows upon it:—

"It may be reasonably assumed that the Lilies exhibited were suffering from the attack of the 'Lily disease,' so called by Marshall Ward in his memoir (in the *Annals of Botany*, vol. ii. p. 319, pl. xxii. to xxiv., 1889). This is stated to be due to a white mould, of the genus *Botrytis*. Most of the species are only a conidial stage of a trumpet-shaped fleshy fungus called a *Peziza* in past times, but now dignified by the name of *Sclerotinia*, because the cups are developed from a hard sclerotium, which is the hybernating mycelium of the mould. In the present instance I am not aware that the sclerotium has been observed, and certainly not

the *Peziza*; hence it would be rather premature to give the supposed *Peziza* a name, before its existence has been demonstrated. Moreover, Marshall Ward has not given a specific name to his *Botrytis*, although he has described it with its cluster of egg-shaped conidia. Berkeley described, in 1881, a species of white mould growing upon Lilies, which he called *Ovularia elliptica*, from its elliptical conidia (*Gardeners' Chronicle*, Sept. 10, 1881, fig. 66). This nevertheless is a species of *Botrytis*, since called *Botrytis elliptica*, and probably is Marshall Ward's species. Long previous to the above, Corda figured and described a white mould, with ovate conidia, in glomerules, which was found growing on immature fruits of Lilies in Bohemia; afterwards cited in other parts of Europe. This mould he called *Polyactis cana*, but during the recent revision of all species of fungi, by Saccardo, it has been called *Botrytis canescens*. Whether it is different from *Botrytis elliptica* I cannot say. Another species of *Botrytis* has been found in Britain and Holland, on leaves, stems, and flowers of cultivated Tulips. It is called *Botrytis parasitica* (Cavara, *App. Pat. Veg.* 10, tab. vi., figs. 1 to 4). This is probably different from the *Botrytis* on Lilies, although it is not improbable that it might develop upon Lilies if it came in contact with them. Having in view the conference which is shortly to take place, it may be interesting to allude to all the fungoid diseases of Lilies which have come under my notice; and, in this connection, it is satisfactory to learn that the number of pests is below the average of plants so largely cultivated. No other parasitic mould has been recorded, and, only recently, one species of *Mucor* which attacks Lily bulbs raised in Japan for exportation to Europe. This species is *Rhizopus necans*, described by Massee (*Kew Bulletin*, 1897, p. 87, with plate). It attacks the bulbs, which soon become rotten, and exhibit clusters of tiny filaments with black heads, like miniature pins. These heads enclose minute conidia, while resting spores or zygospores are produced within the tissues of the decayed bulbs, and thus perpetuate the species after a period of rest. The section of fungoid parasites which include the smuts, rusts, and brands is represented, although there is no smut such as infests *Erythronium* or *Ornithogalum*. The cluster-cup of the Lily of the Valley *Æcidium Convallariæ* has occurred on *Lilium canadense*, and another cluster-cup (*Æcidium*) occurs on Martagon Lilies in Siberia. Of the brands with simple teleutospores consisting of a single cell, the most common is *Uromyces Erythronii* on *Lilium canadense*, in Europe; and another, less common, probably unknown in Europe, is *Uromyces Lilii*, described as a pest of Lilies in the United States. To these must be added the brands with two-celled teleutospores, but I am not aware that *Puccinia Liliacearum*, notwithstanding its name, has been found to attack Lilies, although it is known in Britain on *Gagea* and *Ornithogalum*. Two other species, *Puccinia Tulipæ* and *Puccinia fallaciosa*, attack Tulips, so that, on the whole, the Lilies are favoured by almost complete immunity from these forms of fungoid pests.

The last group or section of parasites to which I need allude are the leaf-spots caused by incomplete fungi, called the Sphæropsideæ. Here, again, the British cultivator may congratulate himself, since *Phyllosticta liliicola*, on the leaves of *Lilium candidum*, has not extended beyond

Italy; and *Phyllosticta Lilii*, on *Lilium superbum*, is at present confined to Canada. There is an allied parasite, with some technical differences, called *Cylindrosporium inconspicuum*, found on leaves of the Martagon Lily, but at present confined to Switzerland. Altogether, this report should give courage to the English cultivator of Lilies, inasmuch as the 'Lily disease' so called, associated with *Botrytis*, is the only one which need cause anxiety."

Rev. W. Wilks observed that the best remedy for *Botrytis* was to shake the diseased Lily bulbs in a bag of sulphur and then to replace them in the ground, but not too deeply.

Lily Hybrids.—Mr. Bowles exhibited blossoms of *L. Dalhansoni*, the result of *L. dalmaticum* × *Hansoni*, to show the difference in colouring.

Hybrid Passion-Flowers.—Dr. J. H. Wilson, St. Andrews, sent specimens (both leaves and flowers) of a hybrid Passion-Flower, mentioned on p. 166 of the Hybrid Conference Report; viz., *P.* 'Constance Elliot' × *P. alba.* The plant grows in an extraordinarily luxuriant fashion, flowers profusely, and produces numerous yellow, seedless fruits. The leaves are either five-lobed or three-lobed, the latter being in the minority. He believes this Passion-Flower to be a new form, and a first-rate garden acquisition. No steps have been taken yet towards distribution.

He also sent specimens of the reciprocal cross referred to on p. 159 of the Report. It bears a close resemblance to the above, but the leaves with three lobes are in the majority, and the styles are not purple.

Tuberose Diseased.—Some specimens were received from Mr. C. Maers, Hockley, Essex, upon which Dr. M. C. Cooke reports as follows:—"In the decayed crown of the corm I find no mycelium, or evidence that the decay was caused in the first instance by fungus; but plenty of insects were present." Dr. Masters observed that such decay was usually at the base, not at the apex, of the corm, as in the present instance.

Carnations Diseased.—Mr. G. Roberts, of Exton Park, sent some plants which were in a failing condition. Dr. M. C. Cooke examined them, and reports as follows:—"The Carnations evidently suffered in the first instance from worm at the roots; afterwards, when the foliage was failing, they became attacked by the Carnation mould *Heterosporium echinulatum* (figured in *Gard. Chron.*, August 21, 1886, fig. 50). It is doubtful whether these particular black moulds will attack healthy and vigorous plants; but when they are weak, sickly, or injured, they then become a ready prey."

Apple-stems attacked by Caterpillars.—Specimens were sent by Mr. W. Camm, from Battle Abbey, upon which Mr. Saunders reports as follows:—

"The Apple-stems are, I should say, undoubtedly bored by caterpillars of the 'Wood Leopard-Moth' *Zeuzera æsculi.* The entrance to the gallery may be easily found by examining the tree, and if moisture is seen to be exuding from any part, mixed with sawdust-like particles of wood, there the hole will be found; a sharp-pointed wire should then be passed in as far as possible, so as to stab the caterpillar. If this cannot be accomplished, the entrance should be somewhat enlarged, and some tow or cotton-wool steeped in tar or paraffin oil should be pushed in as far as possible so as to stifle the insect. When no more can be got in,

the entrance should be closed tightly with well-kneaded clay or wax. If a large grey-and-white moth with delicately-spotted wings is found on the trees, it should be killed, as it is probably the parent insect."

Palms Flowering.—Mr. A. Doig, Dulwich, sent a portion of the male inflorescence of *Chamærops Fortunei.* The plant is described as being some 4 feet high to the top of the crown. Another plant has flowered at Chislehurst this season, and a third elsewhere. Lastly, a fourth has flowered after an interval of twenty-seven years. This summer has therefore appeared to be particularly favourable to the flowering of Palms in the open air.

Plants from Asia Minor.—Miss Willmott sent specimens of a white-flowered Larkspur, and a golden-yellow *Centaurea*, both of which appear to be new to science, and at present unnamed.

Lavender, failing.—Plants were received from Mr. A. H. Smee which failed to produce their flower-spikes. The stems were remarkable for the large size, and flat form of the leaves; the leaves on the lower part being small and with serrated margins. This feature appeared to show that the plants had grown in too moist a locality, the vegetative vigour being abnormally stimulated; possibly also a frost had arrested the flower-spikes.

SCIENTIFIC COMMITTEE, JULY 30, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, with eleven members present, and Monsieur Marc Micheli, Geneva, visitor.

Helianthus supposed Hybrid.—Mr. Buffham sent a flower, of which he writes:—"I think it is a real hybrid; the seed-bearing parent was the annual variety fertilised with *Harpalium*, and possibly with *H. multiflorus* as well." Not having blossoms of the parents for comparison, it was thought hazardous to express an opinion as to the true nature of the plant; and the reference to a possible third parent was not very clear.

Pear Mite.—Leaves of Pears attacked by this common parasite were received through Mr. Gaut, of the Yorkshire College, Leeds, from Mr. Brotchie, of Grimble Park, Saltburn. This insect is practically not injurious to the trees unless it occurs in enormous numbers. Monsieur Micheli observed that such was also the experience of fruit-growers in Geneva.

Eggs on Apple-stems.—Captain Shortt sent specimens, observing that "a pound of Apples were bought in Worthing about April. They were of Tasmanian origin, and on the stalk of each, as well as on the hollow portion of the Apple adjoining the stalk, were some reddish eggs." Mr. Saunders reported as follows upon them:—"I have examined the eggs on the stalk of the Tasmanian Apple, and as far as I can tell they are the eggs of one of the mites. I am keeping them to see if they will hatch, but considering the time that they must have been laid I am afraid that they are addled. The fruit, however, probably came over in a cool chamber, so that may have retarded their hatching; or they may have been eggs which would not naturally hatch until the spring; I mean the antipodean spring."

Apricots splitting.—Mr. Worsdell observed that he had noticed that many Apricots had the flesh split open this season, but not the stones. Mr. Bowles remarked that he had experienced a similar occurrence in previous years, and attributed it to the extreme drought.

Cucumber proliferous.—Dr. Masters exhibited flowers of both male and female Cucumbers in which the axes had thrown out other blossoms. He undertook to report upon the monstrosity. It was, however, a remarkable fact that the three specimens came from Ireland, Dorsetshire, and Middlesex respectively, within a few days of each other. As far as

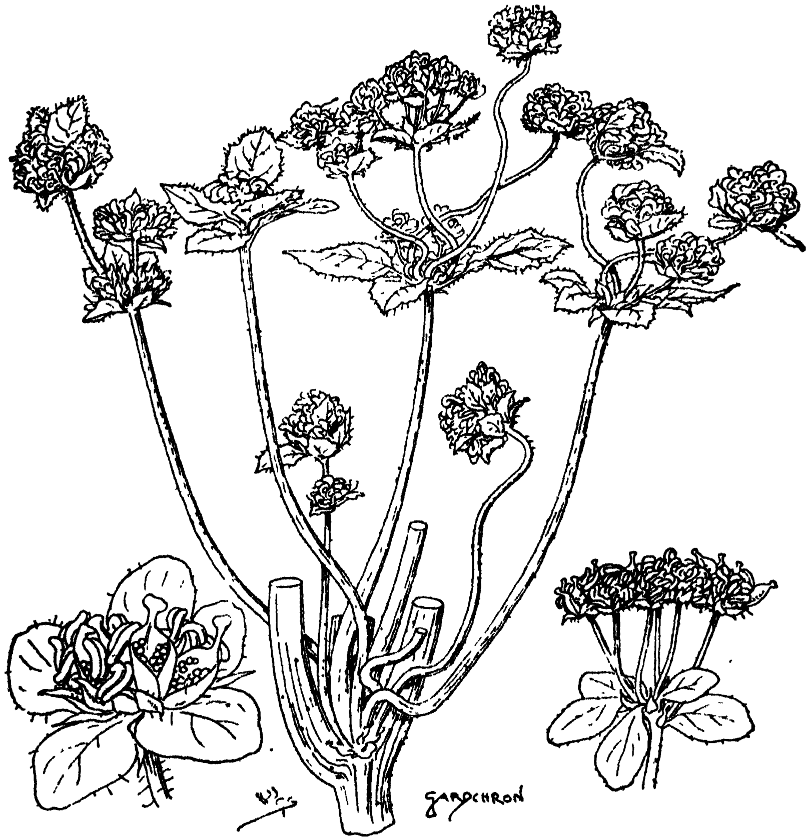


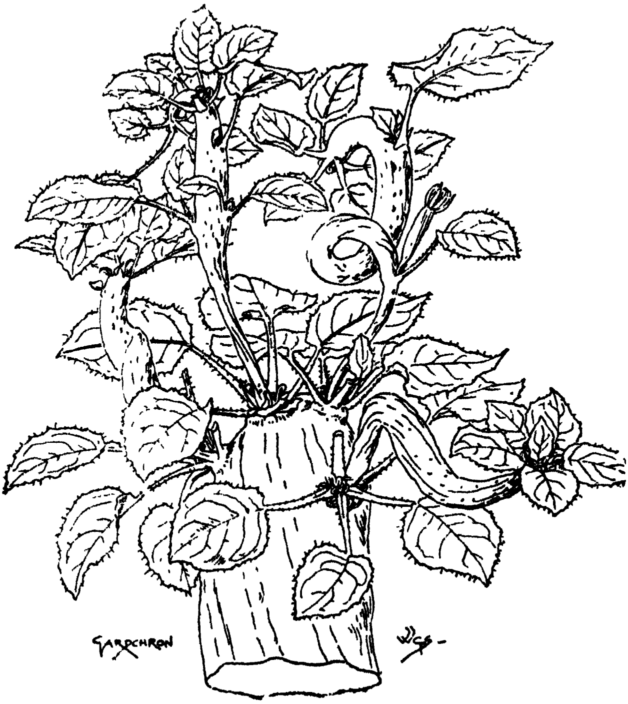
FIG. 245.—Repeated branching of the Inflorescence in a Male Flower of Cucumbe leafy condition of the Calyx; Isolation of Stamens, Production of Hermaphrodi Flowers, &c. (*Gardeners' Chronicle.*)

he knew, no such occurrence had ever been recorded before. Dr. Masters subsequently, after examination, reported as follows :—

"The malformations were exceedingly curious, so much so that in a rather long experience I have never met with any similar. It is the more remarkable, therefore, that we should have received all these specimens from widely separated localities within a few days of each other. In essentials these flowers, male and female respectively, were identical, but with various minor differences in detail.

"In the case of the male flowers, of which remarkable specimens were

sent by Mr. Swan, the sepals were nearly normal, the petals more or less leafy. Within the petals, where in ordinary circumstances we should expect to find the stamens, was a tuft of flower-stalks, each terminated by a globose head of green scales, intermixed with which were a number of more or less perfect but detached stamens, and sundry carpels, free at the edges, which bore numerous ovules. The apex was terminated by a short style, capped with a somewhat globose stigma. The flower was, therefore, hermaphrodite, or at least bisexual, a condition which occurs sometimes in the nearly-allied Begonias. The illustration (fig. 245) shows a small portion only of this much-branched inflorescence, together with a male flower prolified, and, on the left, one of the secondary flowers from



IG. 246.—Portion of Female Flower and Fruit of Cucumber, showing Prolification lateral and axillary, production of Secondary and Tertiary Fruits, and other changes. (*Gardeners' Chronicle.*)

the prolified flower showing the petals, the stamens, and the open carpels.

"The marginal nature of the placenta is obvious, and will be of interest to those who remember the controversy that was waged as to the nature of the placenta of Cucurbits some sixty years since! Others will remember the discussion carried on some forty years ago by Sir Joseph Hooker, the late Charles Darwin, and others, as to the bisexual flowers of Begonias.

"In the female flower the condition of affairs was, making allowance for the difference in sex, very similar. It will be remembered that the outer part of a Cucumber or Gourd is really a dilatation of the flower-stalk into what is called a receptacular cup or tube. With this tube the

carpels are blended, so as to become embedded in and inseparable from it. In some Gourds this state of things is very apparent, because the true carpels project beyond the flower-tube in a more or less dome-shaped prominence at the top of the fruit. Exactly the same condition occurred in the flowers sent by Messrs. Cannell. The flower-tube bore at its margins five stalked leaves, and the true carpels protruded for the space of an inch above these calycine leaves, covered as usual with a rind, the origin of which is one of the puzzles to be solved.

"But this state of things was simplicity itself in comparison with what occurred in the specimens reproduced in fig. 246. Here both from the sides of the original receptacular tube, and from its edge, protruded secondary flowers of the most singular appearance. The calyx was represented by five stalked leaves, at the base of which were some minute, thread-like processes, perhaps representatives of stamens, and in the centre a secondary axis in the form of a small Cucumber, often contorted, and bearing a leafy calyx surrounding a mass of imperfect petals and stamens. In some cases tertiary shoots might be seen springing from the sides of these secondary productions, and constituting, as it were, a double or two-fold prolification.

"In brief, the main peculiarities of these flowers were dependent on an altogether abnormal degree of branching in the floral axis beneath and also within the calyx; in the more or less complete substitution of leaves for sepals and petals; in the production by prolification of tertiary flowers, some axillary, others from the sides of the secondary flowers; in the isolation and multiplication of the stamens; in the production of carpels in the same flower with the stamens; in the complete detachment of these carpels from the axis, and in the want of union between the margins.

"I am afraid Cucumber-growers will not quite appreciate such productions. They may be reassured by their extreme rarity. Botanists will, however, be interested in these extraordinary deviations from the normal conformation, which would be unintelligible without the aid of Mr. Worthington Smith's excellent drawings." (Figs. 245, 246.)

Wood Leopard-Moth.—Young Ash-trees were received from Mr. Ll. Lloyd, of Blandford Lodge, Chiswick, who observes that "the whole tree, the stem being a foot thick, and branches, were all bored. The tree is about 30 feet high. Similar borings occur in both Lilac and Laburnum."

Scientific Committee, August 13, 1901.

Dr. M. C. Cooke, M.A., LL.D., in the Chair, and eleven members present.

Iris-leaves Diseased.—Rev. W. Wilks brought leaves of a German Iris thickly bestrewn with brown spots, which become confluent, and eventually bring about the death of the plant. Dr. M. C. Cooke identifies the fungus as *Heterosporium gracile*, and recommends spraying with sulphide of potassium or ammoniacal solution of copper. All diseased leaves should be forthwith burnt. (See p. 450.)

Banana Disease in Egypt.—Mr. Lionel Sanders, of Ramleh, made

some inquiries about this, but, in the absence of specimens, the Committee could not pronounce an opinion.

Ceropegia debilis.—Mr. Odell exhibited specimens of this curious stove climber from the Zambesi.

Lycoris squamigera and other Flowers.—Mr. Worsley showed flowers of this species which turn of a slaty-blue when exposed to the light. Also flowers of a *Hippeastrum* with rosy, acute, perianth segments, traversed by veins of a deeper colour. The leaves are produced some months after the flower is expanded. The filaments are more exsert than in *H. stylosum*, to which it is nearly allied. Also flowers of the single and double varieties of *Zinnia Haageana*, and of *Tagetes patula nana*. Seeds from this latter form, known as 'Cloth of Gold,' produced pure yellow flowers, and some had, except in their dwarf habit, reverted to the large African Marigold. Both single and double forms were observed. Mr. Worsley also alluded to the variation in the Dahlia. Seeds of a white-tipped variety produced 70 per cent. of self-coloured flowers, and 30 per cent. of flowers varying in colour from red and yellow to white.

Diseased Crocus Corms.—Mr. Bowles showed diseased corms, which were referred to Dr. Cooke for examination.

Proliferous Aconite.—Mr. Bowles also showed flowers of an Aconite, in which the stamens and carpels were absent, and in their place were secondary flower-buds, each with five green sepals, no petals, numerous stamens, and generally no carpels.

Plantago major.—Mr. Bowles exhibited fine specimens of the so-called 'Rose Plantain,' in which the bracts are replaced by tufts of large green leaves.

Mandragora officinalis.—The egg-shaped fruits of this species were shown by Mr. Bowles.

Osmunda regalis.—Mr. C. T. Druery exhibited fronds of an entirely new type of *Osmunda regalis* recently found in Co. Kerry by Mr. M. A. Cowan, of Penicuik, and Mr. W. Boyd, of Melrose. Nine plants in all were found, six of which were fertile, and three barren, the latter being more finely cut than the former, and apparently forming the plumose type of the species. In both forms the usually simple pinnules, with quite smooth edges, are deeply lobed on the edges on the lower and larger divisions, which, towards the upper part of the frond, merges into a distinct and thorough tertiary pinnation, rendering the frond extremely handsome. The fertile spikes consist also of rows of bead-like sporangia, while normally these are only slightly lobed. Mr. Druery has named Mr. Cowan's form *Osmunda r. decomposita*, reserving the naming of Mr. Boyd's find until its distinct character is confirmed.

SCIENTIFIC COMMITTEE, AUGUST 27, 1901.

Dr. M. C. COOKE, M.A., LL.D., in the Chair, and ten members present.

Apricot splitting.—Dr. M. C. Cooke reported on the Apricot the pulp of which was found to be split, and a foreign substance growing upon it. This, however, was nothing but the common blue mould which

grows on decaying matter. Mr. Worsdell assigned various causes for the splitting of the fruit.

Silver-Leaf.—Dr. M. C. Cooke stated that it was doubtful if there was any essential relation between gumming and the so-called silver-leaf disease of the Pruneæ. He doubted whether the fungus called *Coryneum Beijerinki* had any causal connection with gumming. On the other hand, gumming in *Prunus japonica* had been traced to *Cladosporium epiphyllum.* Writing of it in the *Gardeners' Chronicle*, Dr. Cooke said:—

"The silver disease of the foliage in species of *Prunus* has been a puzzle and a mystery for nearly a quarter of a century, and is still almost as mysterious as ever. The leaves retain their normal form, and are neither spotted nor blistered, but are deprived of a large portion of their chlorophyll, assuming a silvery appearance, and the whole tree becomes of a sickly habit, and unproductive. No spots or pustules are detected on the leaves, and no fungus mycelium in the tissues, and yet the disease appears to be communicable.

"The only solution which appears to me to be feasible is, that the present disease is closely allied to the 'Peach-yellows' of the United States, and possibly a modification of that disease, and should be studied in connection with the literature of that pest. The latest developments seem to indicate that the primary cause is bacteriosis, which demands close and patient investigation. In that case, if proved to be true, the remedy will be almost as far off as ever, since fungicides cannot be effectually applied to such a deep-seated malady. Edwin F. Smith, of the U.S. Department of Agriculture, says that 'at present Peach-yellows seems nearest allied to the phenomenon in plants known as variegation. It is now recognised that variegation (panachure) in many plants is a disease manifesting itself in stunted growth, imperfect assimilation, hastened development, and feeble vitality.' In a note it is added that 'there is also, as in yellows, an abnormal ratio of the ash constituents, both potash and phosphoric acid being in excess, and lime deficient.'

"There have been several suggestions, and even assertions, that 'Peach-yellows' is caused mainly by bacteriosis, and this feeling seems to have grown stronger in later years, although in 1894 Mr. Edwin Smith was of opinion that 'it is almost certainly not a bacterial disease.' If later writers are correct in assuming that the disease is bacterial, there is almost equal presumption that 'silver-leaf' belongs to the same category.

"What has been said of 'Peach-yellows' is true also of 'silver-leaf.' 'With our present knowledge, the cure of Peach-yellows appears to be impossible.' All the preventive measures resolve themselves into extirpation, and can be summed up in two lines: 'The only thing which can be done is to cut out and destroy all trees as soon as any of the signs have made their appearance. It is best to burn the diseased trees, roots and all, if possible.'

"Both in Pennsylvania and Connecticut, laws are in force to prevent the spread of the disease in Peach-trees known as the yellows, whereby it is enacted that 'it is unlawful for anyone to knowingly or wilfully keep any Peach, Almond, Apricot, or Nectarine-tree infected with the contagious disease known as the yellows,' &c.

"This, then, is the only remedy which the American Boards of

Agriculture have been able to adopt for Peach-yellows, and we fear that it is equally applicable to 'silver-leaf.'"

Miscellaneous Notes.—Dr. M. C. Cooke stated that he had been unable as yet to find any fungus on the Crocus corms submitted by Mr. Bowles, nor on the Violet leaves sent from Ireland; the frosted spots on the latter were due to the precipitation of the salts from the solution with which the leaves had been sprayed. The damage was, however, suspected to be the result of *Phyllosticta Violæ*, in which case the leaves should be sprayed with an ammoniacal solution of carbonate of copper, which acts best when done early in the season, but in any case the diseased leaves should be collected and burned. (See p. 491.)

Gooseberry Shoots.—Some shoots which were shrivelled and dead were exhibited, the assigned cause being the presence of red-spider.

A new case of Apospory.—Mr. C. T. Druery exhibited cultures showing developed masses of prothalli on the soral sites of *Athyrium Filix-fœmina var. cristatum fimbriatum*, raised by Mr. Garnett, of Bowness. A frond of this Fern was exhibited at the recent meeting of the British Pteridological Society, and Mr. Druery remarked at once its great likeness in make to *A. F.-f. clarissimum*, Jones, though it differed from that Fern in bearing long, slender, much-divided tassels at all the tips, rendering it a very beautiful form. On examining the sori they exhibited so strongly the white, woolly character indicative of apospory, that permission was asked and obtained to put some material under culture, the immediate result of which was an extension of the sporangial growth, demonstrating once again that abnormally slender, linear pinnules are correlated with apospory. There are some indications also of apical apospory, but not yet definite enough to be determined with certainty. Soral apospory is, however, beyond a doubt. This represents the fourth instance of apospory in *Athyrium Filix-fœmina.*

Mr. C. T. Druery also exhibited a culture showing apical apospory in *Lastrea pseudo-mas apospora*, already recorded; well-developed prothalli springing from all the fimbriate tips of the crests of the pinnæ.

Gouty Swellings on a species of Silver Fir.—A specimen was shown of the swellings produced by a Coccus-like insect. Petroleum emulsion was recommended as a palliative, and destruction by fire of the affected shoots advised.

Medicinal Plants in the vicinity of old ruins.—Mr. Houston asked for information as to any paper dealing with the presence of herbs around mediæval ruins. The presence of *Aristolochia Clematitis* around the ruins at Godstow, Oxford, was cited as one illustration.

Poisonous Plants.—Mr. Bowles mentioned the poisonous effects produced by contact with the so-called *Ampelopsis Hoggi*, which turned out to be really *Rhus Toxicodendron.* Dr. Masters alluded to many similar cases, all traceable to the distribution from a particular nursery of *Rhus Toxicodendron* instead of *Ampelopsis.*

A conversation arose in connection with this subject, Mr. Druery stating that honey in *any* form produced uncomfortable symptoms with him; and Dr. Cooke alluded to other cases in which Mushrooms produced evil effects upon some persons and not upon others who partook of the fungi at the same time.

Mushrooms in Coal-cellar.—A Fellow of the Society, present as a visitor, exhibited fine specimens of *Agaricus campestris* var. *villaticus*, which was growing abundantly on the walls of his coal-cellar. Salting the walls was recommended as a remedy if the presence of the Mushrooms was considered objectionable.

Cryptococcus fagi.—Specimens of Beech bark were shown in illustration of the abundance of this insect this season; upon a square inch of bark there were literally hundreds of the insect covered with their white flocculent matter. Unfortunately the attack was so widely spread that anything in the way of cure was impracticable, and in some parts of the country—North-east Surrey for instance—it appears as if the Beech as a forest tree was doomed. The Rev. W. Wilks mentioned that in his neighbourhood many of the trees looked exactly as if they had been white-washed.

Twin Apple.—Mr. Hudson sent a specimen of syncarpy, in which two Apples were partly fused together at the base, probably from pressure, causing mutual grafting in a young state.

Ornamental Grasses, &c.—Mr. Worsley exhibited specimens of *Pennisetum macrourum* from South Africa, and of *P. Ruppelli* from Abyssinia. Mr. Worsley also exhibited a *Coreopsis*, in which the ordinary ray-florets had been replaced by regular tubular ones.

"Acotyledonous" germination in Crinum.—Mr. Worsley also stated that since his previous communication on this subject he had found that the seedling plants of *C. yemense* exhibited the same peculiarity.

Two-fold Helianthus.—Dr. Masters exhibited shoots of *Helianthus* "Miss Mellish" of two forms, from the same stock, one stout, erect, green, and robust in habit; the other slender, deep purple, and greatly resembling the shoots of *Harpalium rigidum*, exhibited for comparison.

Scientific Committee, September 10, 1901.

Dr. M. T. Masters, F.R.S., in the Chair, with eight members present, and Mr. Crawshay, visitor.

Sedum Seedlings.—Mr. Holmes called attention to curious differences in the colouring of the flowers of *S. maximum*. He observes, "The flowers as seen at Kew on the rockery are green. Those of the variety *purpurascens* (or *atropurpureum* ?) are purplish, as well as the leaves and stem. In the plant exhibited the colouring appears to follow the development of the flower. The unopened buds have a purplish flush, which seems to disappear when the protandrous stamens emerge; these then assume a pinkish-purple tinge. Finally, when the flower opens, the ovaries are at first green, but subsequently assume the same purplish tint. This looks as if it were adapted, in the first place, to attract insects to the flower when the anthers are mature, and secondly to the ovaries. The flowers on the corymb show some flowers with green ovaries, and some with purplish ones.

Fungus Pests of the Carnation Family.—A paper on the diseases of

Carnations and other genera of the *Caryophyllaceæ* attacked by fungi, accompanied by two plates, was presented by Dr. M. C. Cooke.

Potentilla with Foliaceous Flowers.—Rev. C. Wolley-Dod sent specimens of *P. nepalensis*, in which the parts of the flowers were replaced by tufts of minute green leaves.

Malformed Vetch Leaflets.—Miss Armitage, of Ross, sent specimens of the foliage of a Vetch, in which the leaflets in many cases resembled Pea-pods. A somewhat similar result from the puncture of insects is known to occur to *Pistacia Lentiscus*. In this case it is probably due to an aphis or a mite.

Begonia Subvirescent.—Rev. W. Wilks received and exhibited a flower one petal of which was partially green.

Epilobium, Monstrous.—Mr. Rasor, of Woolpit, Suffolk, sent malformed flowers, observing :—"In a ditch some 40 or 50 yards long were growing hundreds of *E. hirsutum*, one particular batch of which, containing about a score of plants, has flowers similar to those sent. You will observe that instead of the usual rose-coloured petals they are much reduced in size, and have but a faint tinge of colour on the margin." The essential organs were quite perfect, the pollen being shed in the bud, the pistils finally setting abundance of seed, though the flowers were quite unattractive in appearance to insects.

Odontoglossum Diseased.—Mr. Crawshay asked for information as to the cause of the tips of leaves becoming yellow, brown, and black. The spots appear to start anywhere, and in his opinion were endophytic. The disease has been known for six years, and though often examined, a fungus had not previously been discovered. The spots appear on the leaves of the last-formed bulb, as also on three- and four-year-old leaves, though they may be otherwise perfectly healthy, and they cause no difference in the flowers. No certain interpretation had yet been found for the phenomenon, but Dr. Cooke was asked to examine them.

Cotton-trees.—Rev. W. Wilks asked, on behalf of a correspondent, how these trees, presumably the *Bombax* or *Eriodendron* of S.W. Africa, could be destroyed. The large trunks are so soft that the timber cannot be sawn or cut with an axe. Moreover, the natives will not attempt to destroy them, for fear of the spirits which they suppose to reside in these particular trees. Gunpowder and dynamite were suggested, and saturating with saltpetre and then burning might probably prove effective.

Bark stripped off.—Dr. Masters referred to an inquiry made at a previous meeting with reference to strips of bark of an oblong shape, neatly taken off the branches of Larch-trees ; no interpretation could then be given. It has been now suggested that the strips in question may have been picked off by the nuthatches for the purpose of nest-building.

Plum Roots Diseased.—Mr. Veitch sent some specimens, which Dr. M. C. Cooke undertook to examine and report upon.

Viola sylvatica cleistogamous.—Professor Henslow exhibited specimens of this plant in flower and in fruit, observing that he had never found it otherwise than with cleistogamous buds, which are borne in all the axils of the leaves, whereas in *V. odorata* and *V. hirta* they only occur on the runners concealed beneath the leaves. Though not alluded to by Hooker in the *Students' Flora*, it seemed to be an important distinction between

V. canina and *V. sylvatica* and the last two mentioned. The structure of the buds is much the same in all, the petals being reduced to minute green lanceolate structures, the five anthers having spoon-shaped connectives pressed down upon the summit of the pistil. This has a short curved style with truncate stigmatic orifice.

SCIENTIFIC COMMITTEE, SEPTEMBER 24, 1901.

Dr. M. T. MASTERS, F.R.S., in the Chair, and ten members present, with Mr. Pockett from Australia and Mr. Crawshay, visitors.

Maize with Twin Embryos.—Mr. Houston showed plants resulting from two embryos growing from one grain. A similar phenomenon was not uncommon in the Mistleto, Acorns, &c.

Lily of the Valley Diseased.—Mr. Odell brought samples of the foliage, which was quite brown. It was referred to Dr. Cooke for examination, who reported as follows:—

"The large brown spots on the leaves, sometimes occupying the entire leaf, is not a new disease, since it was known to Fries at the very commencement of the nineteenth century, and the fungus producing the spots was called by him *Sphæria brunneola.* The small blackish perithecia, like pin-points, which contain the fruit of the fungus, are very scarce, and often one leaf after another may be examined without finding them. The primary fruit consists of very long thread-like conidia, and in this state the fungus is called *Septoria brunneola.* More rarely still, and apparently after a period of hybernation, a more perfect condition is found, in which asci are produced within the perithecia, each containing eight uniseptate sporidia, and in this condition the fungus is called *Sphærella brunneola.* It is assumed, and not without some show of reason, that the *Sphærella* is a more matured or perfect condition of the *Septoria*, but the relation of the one form to the other has never been demonstrated. It often happens in these minute species which cause the spotting of leaves that the flask-shaped receptacles, called perithecia, which enclose the fruit, are filled at one time with conidia or free spores and at another time with sporidia enclosed in asci. The external appearance of both kinds is identical, the only difference being found in the fructification. In very many cases the more perfect condition has never been met with, but it has come to be held, as a matter of faith, that all the species of *Septoria, Ascochyta,* and *Phyllosticta* which form spots on the leaves of plants are incomplete fungi, and that their more highly developed stage will be found in some Sphæriaceous fungus, in which the sporidia are produced in asci."

Galls on Oak-leaf.—Mr. Saunders showed an Oak-leaf having four galls. These are formed by grubs from eggs laid by *Spathegaster Taschenbergi*, which would produce a parthenogenetic generation of gall-flies known as *Dryophanta scutellaris* in January or February. These would lay their eggs in the buds of the Oak, and small, somewhat conical galls would be found. From these the sexual generation, *Spathegaster Taschenbergi*, would emerge in July. These galls are common, but are usually found singly on the leaves.

Cattleya Gaskelliana.—Mr. Crawshay exhibited a spray of three flowers, in all of which two sepals had yellow streaks occupying their surface, thus slightly simulating the colouring of the labellum.

Miltonia spectabilis.—Mr. Crawshay showed a small imported plant of this genus which had not been potted for eighteen months, but had sent out a flower from the terminal shoot.

Spots on Orchid-leaves.—Mr. Crawshay read several communications from Mr. Bidgood on this subject; he has traced the spots to a fungus, of which photomicrographic illustrations were shown; but as his researches were not completed, a further communication is looked for. The fungus appears to be allied to *Glœosporium.* Dr. Cooke subsequently remarked:—"Of the four leaves or bracts given me to examine only one was possessed of developed pustules, the others were only leaf-stains. I ascertained from the pustules on the one leaf that the fungus mischief has been caused by Anthracnose, as it is called in the United States, produced by some species of *Glœosporium* or *Marsonia.* The conidia were binucleate, which may portend that when fully matured they become uniseptate. The genus depends upon whether the conidia become uniseptate or not. Of the four or five species of *Glœosporium* which have been found on the leaves of Orchids, I am not yet certain to which the present parasite may belong. And as the investigation is already in the hands of another person who has spent a great deal of time and labour in the pursuit, I do not feel that I am justified, in accordance with common etiquette, in pronouncing an opinion whilst he is in charge of the case."

Schinus Molle with Fungus.—Dr. Bonavia sent leaves attacked by *Fumago.* Mr. Pockett said that *S. Molle* was frequently grown in Australia, and that it likes much warmth. In cold districts it often gets black. Dr. Cooke remarked that he had no doubt the majority of horticulturists have been familiar with *Fumago* for the past forty or fifty years, at least ever since Berkeley published his paper in the 4th vol. of the old "Journal of the Royal Horticultural Society" on "Moulds allied to *Fumago.*" The leaves of most forest trees, many evergreen shrubs, and some herbaceous plants are liable to become blackened on the upper surface by something which appears to be an incrustation of soot, and is known to science as *Fumago.* This is a form of fungus growth which is superficial to the leaf, and when sufficiently thick may be removed in flakes by the point of a penknife. This incrustation consists of a dense interwoven network of branched dark brown threads, often forming multicellular ganglia, and producing chains of uniseptate conidia, resembling those common in the genus *Cladosporium,* with which this was at one time associated under the name of *Cladosporium Fumago.* Unlike that pest of the Tomato, the brown mould *Cladosporium fulvum,* which is an endophyte, the present species does not invade the tissues of the plant, and hence does it no injury, except what is done by the incrustation.

It has been remarked that this fungus when attacking the Lime, for instance, almost invariably follows and establishes itself upon the "honeydew." Nevertheless, other plants suffer which are innocent of aphides or honeydew.

There is no necessity for following up the history of this *Fumago varians* except to remark that its full development is attained in species of *Capnodium*, which possess perithecia enclosing sporidia contained in asci.

Hybrid Tomatos.—Mr. Worsley showed some very fine specimens of Tomatos, the result of crossing the Grape-Tomato with a red garden form. The hybrid was remarkable for the number of fruits borne by it, some twenty-five being on one branch; on another were two closely arranged rows of fruit. Another hybrid was between an egg-shaped Tomato and the Grape-Tomato as male parent; the fruits were not large, but remarkably well-shaped.

Tropæolum Hybrid.—Mr. Worsley showed flowers of *T. Lobbianum* × *majus*, which were intermediate in character between the parents.

Agapanthus umbellatus.—Mr. Worsley also showed a flower of this plant with ten leaves to the perianth, from symmetrical increase.

Watsonia Ardernei.—Dr. Masters showed leaves of this plant, which are remarkable for being quite incapable of bearing the least fumigation without injury.

Beech-tree Bug.—Mr. Burbidge, V.M.H., Trinity College, Dublin, sent samples of the well-known pest, *Cryptococcus fagi*, exceedingly common this year He wrote as follows:—"The specimen came from Croydon, where trees 12 feet in circumference have perished. We have it in Dublin on the stem of a Weeping Beech, in the College garden. This stem is of the common Beech, and the weeping variety is grafted upon it, about 5 feet above ground. The pest only infests the bark of the stock up as high as the graft-line, and does not spread or live on the scion or weeping variety above the graft-line." Mr. Burbidge refers to an opinion that this insect never attacks the purple Beech—an undoubted error, as a large tree of it died at Ealing in 1898 from this cause, in Professor Henslow's garden.

Plane-tree Leaves Diseased.—Mr. Burbidge also sent leaves of this tree attacked by *Fumago*. Several other plants, he observes, are similarly attacked by it.

Proliferous Barley.—Mr. Burbidge sent specimens of Barley with extra short ears at the base, imitating the so-called "Egyptian Wheat." They appeared among a crop of "Chevalier." He raised the question whether it could have resulted from a cross with the six-rowed Barley; but without experiment this could not be decided. Probabilities would seem, however, to be averse to this view, as no such crossing would apply to proliferous Wheat and other cereals, or to Plantains, in which it is of common occurrence.

Prunus sp. Diseased.—Dr. M. C. Cooke reported upon specimens sent to the last meeting by Mr. Veitch: "Plum and Cherry and some other orchard trees suffer from the attacks of what are, apparently, wound parasites. These are in the form of a white mycelium, which grows between the bark and the wood, and ultimately kills the tree. This is presumed to be the mycelium of some Agaric, probably growing in the vicinity of the tree, first attacking the root, and then proceeding upwards beneath the bark. From the mycelium alone it is impossible to determine the species, but in such cases it should be noted whether any Agarics

are growing in the neighbourhood of the diseased tree, such, for instance, as *Collybia fusipes*. Berkeley often directed attention to these 'root fungi,' and commented upon their injurious influence. It may be true that they are originally saprophytes, or the mycelium of saprophytes, but they may become parasitic under certain conditions. I expressed this opinion some years since in connection with Conifers in the neighbourhood of Edinburgh, in a case brought for trial in the High Court, but an opposing witness declared the mycelium to be only a saprophyte, and unable to cause an injury. Subsequent investigations in Germany and elsewhere have confirmed my opinion."

Helianthus hybrid.—Mr. Buffham sent flowers of a supposed hybrid between the perennial and annual species of this genus. He observes:—"The seed-bearing parent was an annual variety (this I have no doubt about), and therefore am able to send a flower of it; but I send also the *Harpalium* and *Helianthus multiflorus*, with blossoms of the two seedlings, one of which grew to a height of seven, the other to that of four feet. For years I have been crossing varieties of the annual Sunflower. I then began to cross the annual with any of the perennial species, and I have no doubt, from the results, about some of them being true crosses; the seed parent being the annual species. The offspring never stood the winter, so I was unable to perpetuate them. Two years ago I fertilised the annual species with *Harpalium*, and possibly *Helianthus multiflorus* (this I am not quite certain about). I sowed the seed, and the result was three plants, two which grew about seven feet high, one about four feet. All flowered, but they are not likely to ripen seed. I dug up one plant, and potted it when in full bloom, placing it in a cold greenhouse to ripen seed; it did not do so, but it lived and is still in the same pot. It is different in foliage and growth from any other I possess. The other two plants I left in the open ground; one, a Sunflower, has come up, and I enclose a blossom. It is about seven feet high, growing very erect. It may be one of the three, but I cannot feel certain." With regard to the differences between *Harpalium* and *Helianthus*: Bentham and Hooker describe the former as having two paleaceous awns dilated at the base, and sometimes cleft, but without any intermediate smaller scales noticed by Desfontaines. In the flower of *Harpalium* sent by Mr. Buffham there were the two opposite lateral, and often cleft, very elongated scales; but these were connected with numerous shorter and pointed scales, all being coherent into a caducous ring. The receptacular scales terminate in a blunt end, which is coloured green. *Helianthus multiflorus* differs from *Harpalium* in having no intermediate scales. In this it agrees with the *H. annuus*, var., sent by Mr. Buffham, while the receptacular scales have acute points, also green. In *Helianthus annuus* the receptacular scales are markedly different, being excessively elongated into awn-like terminations of a dark purple colour. With regard to the (?) hybrids, they both agree in having lanceolate sub-scabrid leaves, similar to those of *Harpalium*. The florets have the two longer scales, with a few short ones intervening, but not coherent. The receptacular scales terminate in acute (not acuminate) points, and are thus intermediate between *Harpalium* and *H. multiflorus*. Comparing these supposed hybrids with the hybrid "H. G. Moon"—i.e.

Harpalium (Miss Mellish) × *Helianthus multiflorus*, they entirely agreed with it, as also with a hybrid between *Harpalium* and *H. multiflorus* from a friend. If, therefore, Mr. Buffham's be a cross between the annual and perennial varieties, then the latter is so strongly prepotent or "dominant" that no trace of its parentage is present.

Cucumber-leaf Disease.—Some leaves having been sent for examination, Dr. Cooke reported:—"They are evidently badly infected with the same mould as that we described in 1896 on the leaves of Melons from Totteridge under the name of *Cercospora melonis*. The leaves become spotted with rounded spots up to half an inch in diameter, such spots being of a pale ochry colour, brittle, and soon cracked and broken. It is difficult with a lens to detect any mould on these spots, but when submitted to the microscope the entire substance is found to be traversed by mycelium, which sends up long, slender, olive-tinted hyphæ, which reach upwards of 150 micromillimetres in length. These hyphæ bear long characteristic conidia which attain from 80 to 140 micromillimetres in length and about 7 or 8 in thickness—much thicker than in the majority of species in this genus. They are slightly attenuated upwards, and rounded at both extremities, at first with a row of guttules, and ultimately multiseptate. The conidia are hyaline, with scarcely any tinge of colour, generally slightly curved.

"There is no doubt but that this is the same species as that which attacks the leaves of Melons.

"The great practical question which at once suggests itself is, 'What is the remedy?' In this instance we have to deal with an endophytic fungus, the mycelium of which permeates the tissues, and has obtained a firm footing before any spots appear on the leaves or the plants give any other indication of the presence of the pest. The mischief is all done when the leaves are spotted, and then it is useless to spray with an ammoniacal carbonate-of-copper solution, as has been recommended in similar cases, because the spraying is only superficial, and has no effect whatever upon the mycelium within the tissues, which will still continue to flourish. The only hope lies in the prevention of the spread of the disease to other and healthy plants. The cultivator must be the judge whether it is better to sacrifice and destroy the infested plants at once, since he cannot hope to save them after the disease has broken out. As we are uncertain whether the full description of this parasite has ever been published otherwise than as a note in the *Gardeners' Chronicle*, September 5, 1896, we repeat it here:—

"'*Cercospora melonis*, Cooke. Spots bleached, ochraceous; rounded, about 1 cm. broad, soon breaking up. Hyphæ slender, elongated, olivaceous, simple, septate, 150 μ long. Conidia cylindrical, slightly curved, rounded and obtuse at the ends, attenuated upwards, multinucleate, at length 5–7 septate, hyaline 80–140 × 7–8 μ. On leaves of Melons and Cucumbers.'"

FRUIT AND VEGETABLE COMMITTEE.

Temple Gardens, May 22, 1901.

Mr. G. Bunyard, V.M.H., in the Chair, and thirty-two members present.

Awards Recommended:—

Award of Merit.

To Cucumber 'Famous' (votes, unanimous), from Mr. S. Mortimer, Farnham. Fruit long, dark green, with only a few spines, handsome

Fig. 247.—Mr. George Bunyard, V.M.H., Chairman of the Fruit and Vegetable Committee. (*The Garden.*)

shape, and with a very short neck, raised from 'Telegraph' × 'Duke of Edinburgh.' Several clusters exhibited indicated the free-bearing habit of the plants.

Other Exhibits.

Mr. E. A. Coryn, Waldon, Hornchurch, staged plants of Cucumber 'King Arthur,' a variety with variegated foliage.

Mr. J. J. Upton, Irlam, near Manchester, sent Cucumbers 'Freedom' and 'Up-to-date.'

Messrs. Laxton, Bedford, staged Strawberry, 'The Laxton,' from 'Royal Sovereign' × 'Sir Joseph Paxton.' It was referred to Chiswick for trial.

Fruit and Vegetable Committee, June 4, 1901.

Mr. A. H. Pearson in the Chair, and ten members present.

Awards Recommended:—

Silver Knightian Medal.

To Messrs. Sutton, Reading, for a collection of vegetables.

Silver Banksian Medal.

To Lord Suffield, Gunton Park, Norwich (gr. Mr. W. Allan), for very fine fruit of Strawberry, 'Lady Suffield.'

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. J. Hudson, V.M.H.), for excellent fruits of Plums, 'Jefferson' and 'Early Transparent Gage.' Mr. Hudson stated that he had found these two varieties the best for pot culture out of a very large collection.

To Mr. S. Mortimer, Farnham, for a collection of Melons.

To J. L. Bucknall, Esq., Langley Court, Beckenham, for remarkably fine fruit of Strawberry, 'Royal Sovereign.'

Award of Merit.

To Peach 'Duchess of Cornwall' (votes, unanimous), from Messrs. Rivers, Sawbridgeworth. Fruit rather large, deep, round, with a slight nipple at the apex; skin pale, flushed with red on the exposed side; flesh white, melting, and of delicious flavour, adhering slightly to the stone.

To Melon 'Excellent' (votes, 5 for, 1 against), from Mr. S. Mortimer, Farnham, raised from 'Royal Sovereign' × 'Sutton's Scarlet.' Fruit of medium size, round; skin whitish and well netted; flesh almost a salmon colour, deep, and of excellent flavour.

Other Exhibits.

The Earl of Darnley, Cobham Hall, Kent, sent a dish of Strawberry, 'Royal Sovereign.'

R. C. Foster, Esq., The Grange, Sutton, Surrey (gr. Mr. Simpson), sent Melon, 'Mrs. R. C. Foster,' not quite ripe.

Mr. S. Mortimer, Farnham, staged Melons, 'The Queen,' 'Speciality,' 'Rowledge Hero,' 'Herald,' and 'Esteemed,' none of which were quite ripe.

FRUIT AND VEGETABLE COMMITTEE, JUNE 18, 1901.

Mr. J. CHEAL in the Chair, and seventeen members present.

Awards Recommended :—

Silver Banksian Medal.

To Lady A. Tate, Park Hill, Streatham Common (gr. W. Howe), for magnificent 'Brown Turkey' Figs.

First-class Certificate.

To Strawberry, 'The Laxton' (votes, unanimous), from Messrs. Laxton, Bedford, raised from 'Royal Sovereign' × 'Sir Joseph Paxton.' Fruit large, dark red, firm, and of excellent flavour. The raiser states that "it is as early as 'Royal Sovereign,' but much darker, brighter, and

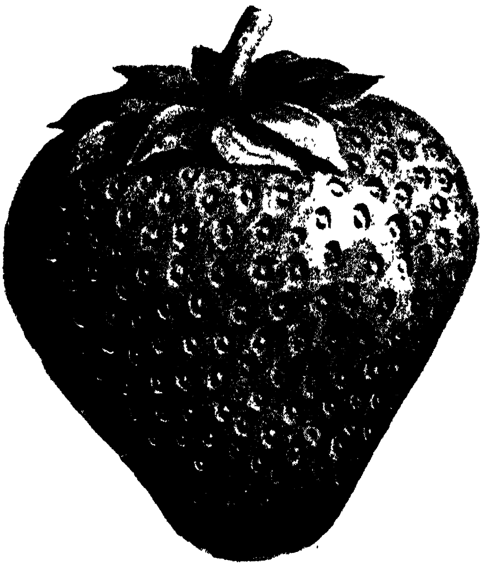


FIG. 248.—STRAWBERRY 'THE LAXTON.' (*Journal of Horticulture.*)

firmer; it is also a better cropper, with a more hardy constitution, cropping more freely on older plants, and does not rot on the ground in wet weather." (Fig. 248.)

Cultural Commendation.

To Mr. G. Harvey, gr. to Mrs. McCreagh, Thornhill, Stanton-in-Peak Bakewell, for large and admirably grown Lemons.

To Mr. A. J. Harwood, St. Peter's Street, Colchester, for several bundles of large well-grown Asparagus.

Other Exhibits.

Capt. Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent two Melons, 'Royal Edward' and 'Baden-Powell': the former a very large fruit with white flesh, and the latter a small fruit with scarlet flesh, both of fair flavour.

Mr. J. Wallace, North Runcton, King's Lynn, sent Cucumber, 'Wallace's Strain,' very similar to 'Lockie's Perfection.'

Whitaker Wright, Esq., Lea Park, Godalming (gr. Mr. A. Cattermole), sent three fruits of Melon, 'Lea Park Seedling.'

Mr. S. Mortimer, Rowledge, Farnham, staged Melons, 'The King,' 'Golden Treasure,' 'Incomparable,' and 'Regina.'

E. A. Hambro, Esq., M.P., Hayes, Kent, sent Melon, 'Conquering Hero.'

R. C. Foster, Esq., Sutton, Surrey, sent Melon, 'Mrs. R. C. Foster,' over-ripe.

Fruit and Vegetable Committee, June 20, 1901.

At Chiswick.

Mr. H. Balderson in the Chair, and twelve members present.

Awards Recommended:—

Award of Merit.

To Pea 'Duchess of York' (votes, unanimous), from Messrs. Sutton, Reading.

To Pea 'Ameer' (votes, unanimous), from Messrs. Sutton.

To Pea 'Ideal' (votes, unanimous), from Messrs. Sutton.

To Pea 'Sutton's Harbinger' (votes, unanimous), from Messrs. Sutton. This variety is distinct from the 'Harbinger' that received an Award of Merit in 1872.

To Pea 'Edward VII.' (votes, unanimous), from Messrs. Carter, High Holborn.

To Lettuce 'Big Boston' (votes, unanimous), from Dr. Masters, F.R.S.

To Lettuce 'Continuity' (votes, 6 for, 5 against), from Messrs. Hurst, Houndsditch; and Messrs. R. Veitch, Exeter.

To Lettuce 'Dwarf Perfection' (votes, unanimous), from Messrs. Barr, King Street, Covent Garden.

To Lettuce 'Little Gem' (votes, unanimous), from Messrs. Barr.

To Lettuce 'Tom Thumb' (votes, unanimous), from Messrs. Hurst and Messrs. Barr.

To Lettuce 'St. Albans All Heart' (votes, unanimous), from Messrs. Hurst.

Fruit and Vegetable Committee, July 2, 1901.

Mr. George Bunyard, V.M.H., in the Chair, and fourteen members present.

Awards Recommended:—

Award of Merit.

To Strawberry 'Givons Late Prolific' (votes, unanimous), from H. P. Sturgis, Esq., Givons, Leatherhead (gr. Mr. W. Peters). Raised from 'Waterloo' × 'Latest of All.' This should prove a valuable late Straw-

berry; the fruit is large, wedge-shaped, dark crimson, with bright red flesh, and of very good flavour. Some plants exhibited showed a very free-bearing habit.

Cultural Commendation.

To Mr. E. Beckett (gr. to Lord Aldenham), Aldenham House, Elstree, for a very fine dish of Pea 'Edwin Beckett.'

To Mr. G. Kelf (gr. to Miss Adamson), South Villa, Regent's Park, for a splendid dish of Strawberry 'Waterloo.'

Other Exhibits.

Mr. R. Staward, Danesfield, Walton-on-Thames, sent a Pea raised from 'Veitch's Perfection' × 'William I.' The Committee desired that it be sent to Chiswick for trial.

Messrs. Laxton, Bedford, staged Strawberry 'Climax'; a large, dark-coloured, wedge-shaped fruit, with the seeds buried in the flesh; raised from 'Latest of All' × 'Waterloo.'

Lord Braybrooke, Audley End, Saffron Walden (gr. Mr. J. Vert), sent Melon 'Golden Wedding,' raised from a green-fleshed hybrid and 'Perfection.'

Duke of Northumberland, Syon House (gr. Mr. G. Wythes, V.M.H.), sent Melon 'Wythes' Victoria,' which was scarcely ripe.

Messrs. Bunyard, Maidstone, staged large fruit of Strawberry 'Latest of All.'

Fruit and Vegetable Committee, July 5, 1901.

At Chiswick.

Mr. George Bunyard, V.M.H., in the Chair, and twelve members present.

The Committee examined a large collection of Peas and Lettuce growing in the Gardens.

Awards Recommended:—

First-class Certificate.

To Pea 'Prize-winner' (votes, unanimous), from Messrs. Sutton, Reading.

Award of Merit.

To Pea 'The Sherwood' (votes, unanimous), from Messrs. Sutton, and Messrs. Hurst, Houndsditch.

To Pea 'Dwarf Telephone' (votes, unanimous), from Messrs. Carter, High Holborn.

To Pea 'Danby Stratagem' (votes, unanimous), from Messrs. Carter.

To Pea 'Sharpe's Queen' (votes, unanimous), from Messrs. Sharpe, Sleaford.

To Pea 'Prolific Late Marrow' (votes, unanimous), Messrs. J. Veitch, Chelsea.

To Pea 'Perfect Gem' (votes, unanimous), from Messrs. Sutton.

To Pea 'Dwarf Defiance' (votes, unanimous), from Messrs. Sutton.

To Pea 'Duke of Albany' (votes, unanimous), from Messrs. Sutton.

To Pea 'Centenary' (votes, unanimous), from Messrs. Sutton.

To Lettuce 'Jumbo' (votes, unanimous), from Messrs. Carter, and Messrs. Barr, Covent Garden.

To Lettuce 'Duke of Cornwall' (votes, unanimous), from Messrs. R. Veitch, Exeter.

To Lettuce 'New Yorker' (votes, unanimous), from Messrs. Barr.

To Turnip 'Red-top Stump-rooted' (votes, unanimous), from Messrs. J. Veitch, Chelsea.

To Melon 'Wythes' Victoria' (votes, unanimous), from Mr. G. Wythes, V.M.H., Syon House, Brentford.

Highly Commended.

To Lettuce 'Harbinger Forcing' (votes, unanimous), from Messrs. Barr.

The following resolution was proposed and carried unanimously, viz.: — "The members of the Fruit and Vegetable Committee present desire to express their opinion that the Pea trials of 1901 are the most extensive and the best cultivated that have been seen at Chiswick for many years past, and their clean condition reflects great credit on the Superintendent."

Fruit and Vegetable Committee, July 16, 1901.

At Chiswick.

Mr. A. Dean in the Chair, and twenty-four members present.

Awards Recommended:—

Silver Knightian Medal.

To Lord Llangattock, The Hendre, Monmouth (gr. Mr. T. Coomber), for 18 admirably grown 'Queen' Pineapples.

To Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kelf), for a collection of fruit.

Silver Banksian Medal.

To Messrs. Ray, Teynham, Kent, for 18 dishes of Cherries.

To Baron Nathaniel de Rothschild, Hohe Warte, Vienna (gr. Mr. Roberts), for a group of Pineapples.

Award of Merit.

To Strawberry 'Queen Alexandra' (votes, 12 for, 4 against), from Mr. A. Wright, Mundesley Road, North Walsham. This variety was said to be raised from 'Waterloo' × 'Frogmore Late Pine' × 'Latest of All,' and is said to be dwarf, compact, free-bearing, and a fine late variety. Fruit large, conical, very dark in colour, with crimson seeds; the flesh is firm, luscious, and possesses a distinct Pine flavour. The mention of three parents is retained, being so recorded by the raiser, but the matter is one of great doubt.

Cultural Commendation.

To the Horticultural College, Swanley, for a collection of Melons.

Other Exhibits.

Messrs. J. Veitch, Chelsea, sent Strawberry 'The Khedive,' from 'Lord Suffield' × 'British Queen.' A handsome dark-fruited variety, of good flavour, but over-ripe.

The Marquis of Bute, Cardiff Castle, Cardiff (gr. Mr. A. Pettigrew), sent splendid fruits of Melon 'Royalty.'

Messrs. Bunyard, Maidstone, staged some remarkably prolific branches of Cherries, as a sample of the Kent Cherry crop.

Mr. F. Bixley, Strand, W.C., sent large Red Currants.

Messrs. R. Veitch, Exeter, sent Pea 'Glory of Devon.'

J. T. Strange, Esq., Aldermaston, Reading, sent some well-fruited sprays of *Eleagnus edulis.*

H. P. Sturgis, Esq., Givons, Leatherhead (gr. Mr. W. Peters), sent good fruit of Strawberry 'Givons Late Prolific.'

Rev. W. Wilks, M.A., Shirley Vicarage, Croydon (gr. Mr. Child), brought remarkably fine fruits of the Logan Berry, and also delicious Jam made of the same.

Duke of Northumberland, Syon House (gr. Mr. G. Wythes, V.M.H.), staged Melon, 'Wythes' Victoria,' from 'Syon House' × 'Epicure.' Fruit of medium size, round, green, and well-netted skin, with flesh of a deep green colour and excellent flavour.

The Horticultural College, Swanley, sent an unnamed Melon from 'Best of All' × 'Hero of Lockinge.'

R. B. Berens, Esq., Kevington, St. Mary Cray, sent fruit of the White Strawberry 'Bicton Pine.'

Mr. A. Kay, Barrowgate Road, Chiswick, sent excellent fruit of 'Red Dutch' Currants.

R. Leigh, Esq., Barham Court, Maidstone (gr. Mr. G. Woodward), sent very large fruit in long clusters of Black Currant 'Boskoop'; a promising variety, which the Committee wished tried at Chiswick.

Mr. A. Wright, Bucklebury Place Gardens, Berks., sent Melons, 'Best of All' and 'Royal Favourite.'

FRUIT AND VEGETABLE COMMITTEE, JULY 30, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twelve members present.

Awards Recommended :—

Silver-gilt Knightian Medal.

To Messrs. J. Veitch, Chelsea, for 100 dishes of remarkably fine Gooseberries. The educational value of such a comprehensive exhibit can hardly be exaggerated.

Award of Merit.

To a Patent Bottle for Preserving Fruit and Vegetables (votes, unanimous), from Mr. De Luca, 5 Long Lane, Aldersgate Street, London. This bottle is most admirably adapted for preserving fruit and vegetables. The lid of the bottle should not be screwed down tightly until after the boiling point has been reached, thus allowing the steam to escape. The

lid is afterwards screwed down tightly on to an indiarubber band surrounding the neck of the bottle, excluding air most effectually. The contents of the bottle will keep fresh and good for a number of years, and appear as if only recently done.

To Gooseberry, 'Gunner' (votes, unanimous), from Mr. T. R. Cuckney, Cobham Hall, Gravesend. Fruit large, round, brownish yellow, hairy, and of very good flavour for a large Gooseberry. (Fig. 249.)

Other Exhibits.

Miss F. S. Musgrave, Ardmore, Youghal, sent fruit of Cherry, 'Raleigh'; a small dark-coloured fruit useful for dessert or stewing.

Mr. G. Lee, Clevedon, sent fruit of Currant 'La Versaillaise,' which arrived in very bad condition owing to defective packing.

Messrs. Cross, Wisbech, sent fruit and fruiting branches of Apples 'Early Victoria.'

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon),

FIG. 249.—GOOSEBERRY 'GUNNER.' (*Journal of Horticulture.*)

sent fruits of Pear 'Green Chisel,' also Melon 'Holland House,' a large, oval, yellow, and beautifully netted, white-fleshed variety.

FRUIT AND VEGETABLE COMMITTEE, AUGUST 2, 1901

AT CHISWICK.

Mr. JOHN WRIGHT, V.M.H., in the Chair, and seven members present.

The Committee examined 78 stocks of Cabbage, 18 stocks of Dwarf French Beans, and 22 stocks of Early Potatos, of which five were so good in form and so prolific that the Committee had them cooked, viz.:—

'Early Jubilee,' 'Early Wonder,'
'Express,' 'Glory of Denbigh,'
'King of the Earlies.'

Awards Recommended :—

Highly Commended.

Potato 'Early Jubilee' (votes, unanimous), grown from tubers sent by Messrs. Dickson & Robinson, Manchester.

Potato 'Express' (votes, unanimous), grown from tubers sent by Messrs. Sharpe, Sleaford.

Potato 'Glory of Denbigh' (votes, unanimous), grown from tubers sent by Mr. R. D. Hughes, Middle Lane, Denbigh.

Cabbage 'Prince's Improved Nonpareil' (votes, unanimous), grown from seeds sent by Messrs. Nutting, Southwark Street, S.E.

Cabbage 'Little Queen' (votes, unanimous), grown from seeds sent by Messrs. Barr, King Street, Covent Garden, W.C.

Cabbage 'Best of All' (votes, unanimous), grown from seeds sent by Messrs. Barr.

Dwarf French Bean 'Smythe's Fawn' (votes, unanimous), grown from seeds sent by Mr. A. Dean, Richmond Road, Kingston.

Dwarf French Bean 'Surrey Prolific' (votes, unanimous), grown from seeds sent by Mr. A. Dean.

Gooseberry 'Howard's Lancer' (votes, unanimous), from Mr. G. Woodward, Barham Court, Maidstone.

Plum 'Early Yellow' (votes, unanimous), grown on a tree sent to the Gardens by Mr. J. Fraser, South Woodford.

Commended.

Potato 'King of the Earlies' (votes, unanimous), grown from tubers sent by Mr. R. Slowe, Kimbolton.

FRUIT AND VEGETABLE COMMITTEE, AUGUST 13, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and sixteen members present.

Awards Recommended :—

Silver gilt Knightian Medal.

To Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kelf), for a collection of fruit.

Silver Knightian Medal.

To Messrs. Cannell, Swanley, for fruit-trees in pots and 70 dishes of Apples.

Silver Banksian Medal.

To Alderman A. Walker, Low Hills, Lindley, Huddersfield (gr. Mr. B. Lockwood), for 18 excellent dishes of Peas.

First-class Certificate.

To Plum 'Early Yellow' (votes, unanimous), from Mr. J. Fraser, South Woodford. Fruit decidedly small, oval, tapering sharply towards the stalk, which is ½ inch long; colour deep yellow, covered with a paler bloom; flesh yellow like that of an Apricot, parting freely from the stone, but of only fair flavour; foliage rather small, not downy, with prominent

round glands at the base of the leaf and often on the petiole; habit of the tree slender, upright, and compact. A very old free-bearing variety, that ripens its fruit a week earlier than 'Early Prolific,' and should on that account be a useful cooking variety.

Award of Merit.

To Potato 'Early Jubilee' (votes, unanimous), from Messrs. Dickson & Robinson, Old Mill Gate, Manchester.

To Potato 'Express' (votes, unanimous), from Messrs. Sharpe, Sleaford.

To Potato 'Glory of Denbigh' (votes, unanimous), from Mr. R. D. Hughes, Middle Lane, Denbigh.

To Cabbage 'Prince's Improved Nonpareil' (votes, unanimous), from Messrs. Nutting, Southwark Street, S.E.

To Cabbage 'Little Queen' (votes, unanimous), from Messrs. Barr, King Street, Covent Garden.

To Cabbage 'Best of All' (votes, unanimous), from Messrs. Barr.

To Dwarf French Bean 'Smythe's Fawn' (votes, unanimous), from Mr. A. Dean, Richmond Road, Kingston.

To Dwarf French Bean 'Surrey Prolific' (votes, unanimous), from Mr. A. Dean.

To Gooseberry 'Howard's Lancer' (votes, unanimous), from R. Leigh, Esq., Barham Court, Maidstone (gr. Mr. G. Woodward). Fruit large, smooth, green, and very good flavour; habit of bush strong, upright, and a great bearer.

All the above had been Highly Commended at Chiswick on August 2.

To Blackberry 'Wilson, Junr.' (votes, 6 for, 5 against), from Messrs. J. Veitch, Chelsea. Fruit large, black, shining, abundantly produced on the plants, which are usually very vigorous. It is, however, exceedingly doubtful whether selected and well-cultivated varieties of our own native Blackberries would not be equally prolific and of better flavour than any of the American ones.

Cultural Commendation.

To Dr. Bonavia, Westwood, Richmond Road, Worthing, for exceptionally well-grown fruits of *Physalis Peruviana* (syn. *P. violacea*), better known as the 'Cape Gooseberry.'

Other Exhibits.

Messrs. W. Ray, Teynham, Kent, staged very good fruit of Cherry 'Noble.'

Messrs. Cross, Wisbech, sent very fine fruits of Apple 'Early Victoria.'

Messrs. Lack, Wellingborough, brought Red Currant 'Lack's Champion' which, however, proved to be 'Chiswick Red'; also Black Currant 'Lack's Hangwell.'

Messrs. Kelway, Langport, Somerset, sent fruit of the Japanese Honey Berry. Fruit the size of a large Raspberry, of a reddish-yellow colour, covered with prominent seeds, and not very good in flavour. This plant was reported to be a native of an island in the Yellow Sea; making vigorous growth, the canes often attaining a height of 15 feet.

Mr. R. Maher, Yattenden Court Gardens, Newbury, sent Melon

Marquis of Ailsa,' a variety which he had grown since 1856. The fruit sent was over-ripe.

Col. M. A. Swinfen-Brown, Swinfen Hall, Lichfield, sent a Melon from 'Ingestre Hybrid' × 'Sutton's A 1.'

Messrs. Dobbie, Rothesay, sent Beet 'Selected New Purple'; long handsome roots, with exceedingly dark flesh. It is doubtful whether such intensely dark--almost black—Beets are desirable.

Mr. W. Poupart, Marsh Farm, Twickenham, staged very large highly-coloured fruits of Apple 'Langley Pippin.'

Mr. Collins, Surrey Cross, sent a late Black Currant.

FRUIT AND VEGETABLE COMMITTEE, AUGUST 27, 1901.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twelve members present.

Awards Recommended:–

Silver Knightian Medal.

To Messrs. J. Veitch, Chelsea, for a collection of Apples, Pears, Plums, and Currants.

To Messrs. Spooner, Hounslow, for a collection of hardy fruit.

Other Exhibits.

H. M. Buddicom, Esq., Penbedw, Mold, North Wales (gr. Mr. M. Taylor), sent Tomato 'Klondyke,' very similar to 'Comet.'

Captain Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent Apple 'Ruddy,' raised from 'Ecklinville' × 'Mère de Ménage,' a very pretty fruit of the same colour as 'Mère de Ménage,' and possessing a very peculiar and distinct flavour. The Committee desired to see it again, with particulars as to the habit of the tree and its cropping qualities. The same exhibitor also sent Melon 'Baden-Powell,' a large scarlet-fleshed variety.

Henry Nicholls, Esq., M.A., Mill Road, Deal, sent a Nectarine 'Deal Seedling' raised from 'Elruge.' The fruit of the seedling was not considered to be as good as that of the parent.

From the Society's Gardens came fruit of Plums 'Golden Esperen' and 'Windsor Early,' which the Committee decided were synonymous.

Lord Walsingham, Merton Hall, Thetford, Norfolk (gr. Mr. H. Gandy), sent Melon 'Thirkleby Hall,' a large variety with green melting flesh.

FRUIT AND VEGETABLE COMMITTEE, SEPTEMBER 10, 1901.

Mr. J. CHEAL in the Chair, and nineteen members present.

Awards Recommended:—

Hogg Memorial Medal.

To Messrs. William Paul, Waltham Cross, for a very fine collection of fruit-trees in pots and gathered fruit.

Silver-gilt Knightian Medal.

To Mrs. Nix, Tilgate, Crawley (gr. Mr. E. Neal), for a collection of hardy and indoor fruit.

Silver Knightian Medal.

To Messrs. J. Veitch, Chelsea, for a collection of outdoor Tomatos and Plums.

To Messrs. Peed, West Norwood, for fifty dishes of hardy fruit.

To Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kelf), for a collection of fruit.

Silver Banksian Medal.

To Lord Gerard, Eastwell Park, Ashford (gr. Mr. H. Walters), for a collection of vegetables.

Cultural Commendation.

To the Superintendent R.H.S. Gardens for seventy-six dishes of Pears and twenty-five dishes of Plums.

To Mr. W. G. Bashford, Bagot Manor, Jersey, for three magnificent dishes of Pears.

To Mr. W. Camm, gr. to Captain Forester, Battle Abbey, for exceedingly fine 'Dymond' Peaches, grown on open walls.

Other Exhibits.

Mrs. Evans, Forde Abbey, Chard (gr. Mr. J. Crook), sent Apricot 'Powell's Late.'

Mr. W. J. Godfrey, Exmouth, sent Apple 'Venus Pippin.'

Captain Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent Apple 'Ruddy,' which the Committee desired to see again next year; also Plum 'Trump.' from a 'Purple Seedling' × 'Coe's Golden Drop.'

Alderman A. Walker, Lindley, Huddersfield (gr. Mr. B. Lockwood), sent four dishes of Peas, which were thought very good for so late in the season.

Messrs. J. Veitch sent Pear 'Dr. Jules Guyot,' Crab Apple 'Mrs. John Seden,' and Damson 'The Langley.'

Lord Poltimore, Poltimore, Exeter (gr. Mr. T. H. Slade), sent Apple 'Lady Sudeley' and Pear 'Beurré d'Amanlis.'

Mr. E. D. Menzies, Upper Holmwood, Cowes, sent an unnamed Melon.

A. Seth Smith, Esq., Silvermere, Cobham (gr. Mr. J. Quarterman), staged very large fruits of *Passiflora edulis.*

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain), sent fine fruits of Pear 'Clapp's Favourite.'

The Earl of Jersey, Osterley Park, Isleworth (gr. Mr. J. Hawkes), staged four dishes of Peaches and Pears.

The Marquis of Salisbury, Hatfield (gr. Mr. G. Norman, V.M.H.), sent very fine flavoured fruit of Pear 'Beurré de l'Assomption,' a Pear of magnificent flavour, but often badly shaped, and said to be a rather shy bearer.

Lord Malcolm, of Poltalloch, Lochgilphead (gr. Mr. D. S. Melville), sent heavily-fruited branches of *Rubus fruticosus*, the common Blackberry. Mr. Melville stated that he had tried all the American Brambles, including a variety sent from Quebec and said to be a wonderful bearer, but none were to be compared to a selection of our native Blackberries, as they get so large and sweet.

FRUIT AND VEGETABLE COMMITTEE, SEPTEMBER 24, 1901.

Mr. G. BUNYARD, V.M.H., in the Chair, and eighteen members present.

Awards Recommended :—

Silver-gilt Knightian Medal.

To A. Pears, Esq., Spring Grove, Isleworth (gr. Mr. W. Farr), for a very fine collection of Fruit.

Silver Knightian Medal.

To the Horticultural College, Swanley, for a collection of hardy Fruit.

To Messrs. Rivers, Sawbridgeworth, for Plum-trees in pots.

Silver Banksian Medal.

To Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Keif), for a collection of Vegetables.

To Colonel Warde, Barham Court, Maidstone (gr. Mr. F. Walder), for twenty-five Melons.

Other Exhibits.

Leopold de Rothschild, Esq., Gunnersbury House, W. (gr. Mr. J. Hudson, V.M.H.), sent Grape 'Early Auvergne Frontignan' and a large scarlet-fleshed Melon.

H. P. Sturgis, Esq., Givons, Leatherhead (gr. Mr. W. Peters), sent Grape 'Givons Gros Maroc,' a variety with oval berries and the same fine dark colour as the ordinary round-berried variety. The Committee desired to see it again later on in a riper condition.

Mr. E. D. Thomas, Lampeter, South Wales, sent a local Apple 'Cordi'; very pretty, but over-ripe.

The Duke of Rutland, Belvoir Castle, Grantham (gr. Mr. W. H. Divers), sent Plum 'Divers' Late Red.'

Lord Poltimore, Poltimore, Exeter (gr. Mr. T. H. Slade), sent Pear 'Triomphe de Vienne'; very fine, but a little past their best.

Messrs. W. Paul, Waltham Cross, sent six dishes of Peaches and Nectarines grown in the open air on standard trees.

A. Pears, Esq., sent Melon 'Centre of England.'

Mr. F. M. Bradley, Peterborough, staged Potato 'Earl Roberts.' The Committee requested that some tubers be sent to Chiswick for trial.

Dr. Bonavia, Westwood, Worthing, brought two well-grown dishes of Tomatos.

Fruit and Vegetable Committee, October 1, 1901.

At Chiswick.

Mr. W. Bates in the Chair, and twelve members present.

The Committee examined twenty-eight stocks of late Potatos, and by reason of their heavy crop, good shape, and freedom from disease, ordered some of each of the following to be cooked, viz.:—

'Carltonian'
'Chancellor'
'Duchess of Buccleuch'
'Ellington's Prolific'
'Fylde Wonder'
'General Buller'
'General French'
'Improved Kidney'
'Kerr's B.'
'Lovelands Kidney'
'The Crofter'
'The Factor'

Award of Merit.

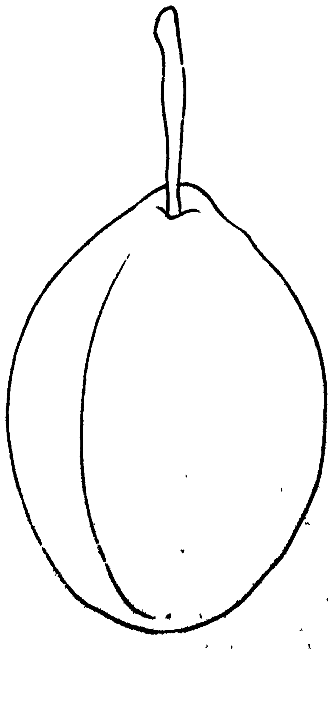
To Potato 'General Buller' (votes, unanimous), from Messrs. R. Veitch, Exeter.

To Potato 'General French' (votes, unanimous), from Messrs. Barr, Covent Garden.

To Potato 'The Factor' (votes, unanimous), from Messrs. Dobbie, Rothesay, N.B.

Commended.

Potato 'Carltonian' (votes, unanimous), from Mr. A. Taylor, Brougham, Penrith, Cumberland.



FLORAL COMMITTEE.

TEMPLE GARDENS, MAY 22, 1901.

Mr. W. MARSHALL in the Chair, and twenty-four members present.

Awards Recommended:—

Award of Merit.

To Hippeastrum 'Lois' (votes, unanimous), from Captain Holford, C.I.E., Westonbirt, Tetbury, Gloucester (gr. Mr. A. Chapman). This produces a stout scape of handsome bell-shaped flowers, 4 inches across each segment; white ground, veined, and shaded with orange-scarlet with a green centre.

To Tree Carnation 'Sir Hector Macdonald' (votes, 8 for, 1 against), from Messrs. Cutbush, Highgate. A sturdy grower with broad 'grass' and large, slightl fragrant white flowers striped with scarlet.

To Tulipa mauriana (votes, unanimous), from Messrs. Wallace, Colchester. This is a native of Savoy and bears bright scarlet flowers with a clear yellow base. The petals are long and sharply pointed, and in general outline bear some resemblance to *T. Gesneriana*, one of the parents of the common garden Tulips.

To Tulip 'Van Poortvleit' (votes, unanimous), from Messrs. Barr, Covent Garden. Large, well-formed flowers, with broad, rosy-scarlet petals striped with blush-white, and a distinct indigo-blue base.

To Tulip 'Dr. Hardy' (votes, 8 for, 4 against), from Messrs. Barr. A distinct variety with showy rich yellow flowers, feathered with crimson and stained with brownish red.

To Tulip 'Annie McGregor' (votes, unanimous), from Messrs. Barr. A beautiful rich rosy-red flower with a band of white down each of the broad segments. The base is white.

To Tulipa Gesneriana ixioides (votes, unanimous), from Mr. Hartland, Cork, and Messrs. Hogg & Robertson, Dublin. Flowers rich yellow, with a very dark base. The petals are broad and substantial.

To Tulipa Batalini 'Sunrise' (votes, unanimous), from Messrs. Hogg & Robertson. The flowers are of similar shape and size to those of the type, and in colour a lovely shade of apricot flushed with salmon. A rather indistinct blue zone surrounds the greenish-yellow centre.

To Tulip 'La Tulipe Noire' (votes, unanimous), from Messrs. Hogg & Robertson. Bold cup-shaped flowers, almost black, with a flush of purple-brown towards the edge of the exterior of the stout petals. The flowers are larger and deeper in colour than those of 'The Sultan,' and it is probably the darkest Tulip in cultivation.

To Androsace chumbyiensis (votes, 11 for, 1 against), from Messrs. R. Veitch, Exeter. A new and lovely plant for the rock garden, as it is dwarf, hardy, easily grown, and very free-flowering. It seems to be intermediate in character between *A. sarmentosa* and *A. villosà*, and in all probability is a hybrid between them. Its umbels of small rose-coloured flowers are borne on erect slender stems about 5 inches high.

To Tree Pæony 'Christine Kelway' (votes, unanimous), from Messrs. Kelway, Langport. Magnificent semi-double pure white flowers, with a cluster of yellow stamens in the centre.

To Rosa polyantha 'Leuchtstern' (votes, unanimous), from Messrs. W. Paul, Waltham Cross. A grand Rose for pillars, pergolas, verandahs, &c. It is free in growth, floriferous, and very handsome. The single flowers are small, rose-colour, passing to silvery-pink with a conspicuous white centre.

To Rose 'Soleil d'Or' (votes, unanimous), from Messrs. W. Paul. This is the result of crossing 'Persian Yellow' with 'Antoine Ducher.' Plant of compact bushy habit, with polished green foliage, similar to that of the first-named parent, and medium-sized, sweet-scented, apricot-coloured double flowers.

To double Begonia 'Mrs. W. G. Valentine' (votes, unanimous), from Messrs. Ware, Feltham. Lovely primrose-yellow flowers, large, full, and very distinct.

To double Begonia 'Mr. Henry Clark' (votes, unanimous), from Messrs. Ware. Large fiery scarlet flowers of good outline, the petals beautifully frilled.

To double Begonia 'Queen Alexandra' (votes, unanimous), from Messrs. Ware. A splendid variety, with pale salmon flowers suffused and edged with orange-scarlet.

To Leucocrinum montanum (votes, 8 for, 1 against), from Mr. Amos Perry, Winchmore Hill. A very uncommon Californian Alpine bulbous plant, rarely exceeding 5 inches high. It bears long tubular, snow-white flowers above the narrow, glaucous leaves with great freedom.

To Lithospermum canescens (votes, unanimous), from Mr. A. Perry. A perfectly hardy, herbaceous perennial, introduced from North America in 1826. It is sturdy in habit, with narrow, hairy, bright green leaves, and bears an abundance of small, deep yellow flowers at the apex of the growths and in the axils of the leaves. It is also known as *Batschia canescens.*

To Swainsonia Maccullochiana (votes, unanimous), from Messrs. Low, Enfield. A greenhouse climber with erect racemes of brownish-crimson pea-shaped flowers with a white centre.

Other Exhibits.

Miss Hopkins, Mere Cottage, Knutsford, sent Daisy 'Alice.'

Monsieur A. Truffaut, Versailles, France, sent *Musa rubra,* a new species from the French Congo, Africa.

From Messrs. R. Veitch, Exeter, came a small collection of rare hardy plants.

Messrs. Newport, Hillingdon Heath, Uxbridge, sent Lobelia 'Newport's Model.'

Mr. Hartland, Cork, sent some very fine Tulips.

M. Lucien Linden, Brussels, sent a large plant of *Conpteris Brazzaiana,* a vigorous and distinct fern with long, broad fronds.

Mr. Godfrey, Exmouth, sent Tropæolum 'Exmouth Glory,' and four varieties of Pelargoniums.

FLORAL COMMITTEE, JUNE 4, 1901.

Mr. W. MARSHALL in the Chair, and twenty members present.

Awards Recommended:—

Gold Medal.

To Messrs. Cannell, Swanley, for a superb exhibit of Cannas.

To Messrs. Jas. Veitch, Chelsea, for Eremurus, Pæonies, *Kalanchoe flammea*, Streptocarpus, and hardy flowering shrubs.

FIG. 250.—INCARVILLEA DELAVAYI.

Silver-gilt Flora Medal.

To Mr. May, Upper Edmonton, for Zonal Pelargoniums.

Silver-gilt Banksian Medal.

To Messrs. Sutton, Reading, for flowering plants.

To Messrs. Wallace, Colchester, for hardy flowers, amongst which Incarvillea Delavayi (fig. 250) was very conspicuous.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Mr. Prince, Longworth, Berks, for Roses.

Silver Flora Medal.

To Messrs. Ware, Feltham, for hardy flowers.
To Messrs. Frank Cant, Colchester, for Roses.
To Messrs. Prichard, Christchurch, Hants, for hardy flowers.

Silver Banksian Medal.

To Messrs. Kelway, Langport, for Pæonies.

FIG. 251.—IVY-LEAF PELARGONIUM 'LEOPARD.' (*Journal of Horticulture.*)

To Messrs. W. Paul, Waltham Cross, for hybrid Rhododendrons.
To Messrs. Cutbush, Highgate, for Spiræas and Eremurus.
To Messrs. Barr, Covent Garden, for hardy flowers and Pigmy trees.

Bronze Flora Medal.

To Messrs. Carter, High Holborn, for Sweet Peas, Petunias and Gloxinias.

Award of Merit.

To Rosa rugosa germanica 'Conrad Ferdinand Meyer' (votes, 7 for, 6 against), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A vigorous growing Rose, with stout bright green foliage, and great quantities of large handsome silvery-pink flowers. *R. rugosa* is, however, scarcely discernible in either the foliage or the flowers. It is a pity that beautiful plants should be so burdened with names.

To Papaver orientale 'Mrs. Marsh' (votes, unanimous), from Mr. Perry, Winchmore Hill. Large bright scarlet flowers, flaked and striped with blush white, and heavily blotched with black at the base of each petal.

To Ivy-leaved Pelargonium 'Leopard' (votes, unanimous), from Mr. May, Upper Edmonton. A very free-flowering variety with large trusses of semi-double pinkish-rose flowers, blotched and streaked with purplish-crimson on the upper petals. (Fig. 251.)

To Ivy-leaved Pelargonium 'Mrs. W. H. Martin' (votes, unanimous), from Mr. May. A seedling from 'Souvenir de Charles Turner,' and of compact bushy habit; very free-flowering; large semi-double flowers borne in great trusses; colour bright pink, passing to silvery pink, the upper petals shaded and striped with crimson.

To Canna 'Oscar Dannecker' (votes, 13 for, 2 against), from Messrs. Cannell, Swanley. A purple-leaved variety with an enormous spike of large rich orange flowers.

To Canna 'Jean Tissot' (votes, 10 for, 6 against), from Messrs. Cannell. The flowers of this variety are large, bright scarlet, and very substantial.

To Canna 'Grossherzog Ernst Ludwig von Hessen' (votes, unanimous), from Messrs. Cannell. Flowers a trifle deeper in colour than those of the last-named. They are also larger and borne in greater trusses. The leaves are purple. The name should surely teach growers to be concise when they have to fix a name for anything.

To Canna 'Elizabeth Hoss' (votes, 15 for, 2 against), from Messrs. Cannell. A magnificent truss of large canary-yellow flowers, heavily spotted with crimson.

To Lewisia Tweediei (votes, 17 for), from Messrs. Barr, Covent Garden. A pretty little plant, but unfortunately not quite hardy. Its bright green fleshy spathulate leaves are set on rather long stout petioles. Flowers single, about the size of a four-shilling piece, borne on sturdy stems; colour pale salmon-pink with golden anthers. It should be planted in rather dry soil and in a sunny position. (Fig. 252.)

To Acer pictum (colchicum) aureum (votes, 9 for), from Messrs. Cripps, Tunbridge Wells. A remarkably fine hardy tree for decorative planting. It is not quite so free in growth as the type. Its golden bronzy leaves, occasionally mottled with green, are set on bright red or crimson footstalks. The bark on the young wood is crimson and very effective even after the leaves have fallen.

To Meconopsis heterophylla (votes, 11 for, 1 against), from Mr. Prichard, Christchurch, Hants. A new and quite distinct annual of

graceful habit, with deeply-cut bright green leaves, and single flowers nearly two inches across, borne on slender stems with moderate freedom; colour bright orange with a dark brown centre.

To Tree Pæony 'Elsie Perry' (votes, 10 for, 3 against), from Mr. Perry, Winchmore Hill. A splendid flower, with broad, crimped, rich maroon petals.

Other Exhibits.

Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr.

FIG. 252.—LEWISIA TWEEDYI. (*The Garden.*)

Jas. Hudson, V.M.H.), sent a small group of *Kalanchoe flammea* and scented-leaved Pelargoniums.

G. Yeld, Esq., Clifton Cottage, York, sent some of his beautiful new seedling Irises (fig. 253), Day Lilies, and Anthericum 'Arethusa.'

Earl of Darnley, Cobham Hall, Kent, sent flowers of *Calycanthus floridus* (Carolina Allspice), introduced to this country in 1726.

F. D. Godman, Esq., F.R.S., South Lodge, Horsham (gr. Mr. Moody), sent two flowering scapes of *Allium Schuberti*, a new species from the Orient.

FIG. 253.—TYPES OF GERMAN IRISES. (*Journal of Horticulture.*)

(*To face page* clxiv.)

W. Wainwright, Esq., Horeham Grange, Sussex, sent Gloxinia 'Lady Bigge.'

From Howson L. Devitt, Esq., Sandlea, Datchet, Windsor, came Tree Carnation 'Mrs. Devitt.'

Messrs. Paul, Cheshunt, sent Roses, hardy flowers, and sprays of ornamental trees and shrubs.

Mr. Wade, Colchester, sent Sweet Peas and hardy flowers.

Messrs. Laing, Forest Hill, sent Gloxinias.

Mr. H. J. Hinson, High Street, Roydon, sent plants and cut flowers of Zonal Pelargonium 'Baden-Powell,' a new variety with large trusses of bright orange-scarlet double flowers.

Messrs. Peed, West Norwood, sent Hydrangeas.

Messrs. Jackman, Woking, sent a small collection of hardy flowers.

Mr. Godfrey, Exmouth, sent Poppies.

From Messrs. Walshaw, Scarborough, came a new seedling Carnation named 'Madeline Reynolds.'

Mr. Smith, Penrose Street, Walworth, sent, *Lupinus polyphyllus bicolor.*

Messrs. Newport, Uxbridge, sent Lobelia 'Newport's Model.'

Messrs. Boyes, Leicester, sent Carnations.

Messrs. Cheal, Crawley, sent an interesting collection of sprays of hardy flowering trees and shrubs.

Messrs. Low, Enfield, sent Carnations and *Schizanthus wisetonensis.*

FLORAL COMMITTEE, JUNE 18, 1901.

Mr. C. E. SHEA in the Chair, and twenty-four members present.

Awards Recommended :—

Gold Medal.

To Messrs. Jas. Veitch, Chelsea, for Streptocarpus, Gloxinias, Solanums, Pæonies, Roses, and hardy shrubs.

Silver-gilt Flora Medal.

To Mr. Prince, Longworth, Berks, for Roses.

To Messrs. Frank Cant, Colchester, for Roses.

To Messrs. B. R. Cant, Colchester, for Garden Roses.

To Messrs. Kelway, Langport, Somerset, for Pæonies and Delphiniums.

Silver-gilt Banksian Medal.

To Mr. Perry, Winchmore Hill, for hardy flowers.

Silver Flora Medal.

To Lord Aldenham, Elstree (gr. Mr. E. Beckett), for Streptocarpus.

To Messrs. Bath, Wisbech, for Pæonies.

To Messrs. Wallace, Colchester, for hardy flowers.

To Messrs. Dobbie, Rothesay, for Pansies, Violas, and Sweet Peas.

To Messrs. Prior, Colchester, for Roses.

To Messrs. Paul, Cheshunt, for Pæonies and Roses.

Silver Banksian Medal.

To Lady Nina Balfour, Newton Don, Kelso, for Malmaison Carnations.

To Messrs. Davis, Yeovil, Somerset, for Begonias.

To Messrs. Spooner, Woking, for Decorative Roses.

To Messrs. Low, Enfield, for Carnations.

To Messrs. Cheal, Crawley, for sprays of hardy flowering trees and shrubs.

To Messrs. Ware, Feltham, for hardy flowers.

To Mr. H. J. Jones, Lewisham, for Begonias and Ivy-leaved Pelargoniums.

To Messrs. Jackman, Woking, for Roses.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Mr. May, Upper Edmonton, for flowering plants.

To Messrs. Peed, West Norwood, for Alpines and hardy flowers.

Award of Merit.

To Gloriosa lutea (votes, 10 for, 5 against), from the Hon. Mrs. Evelyn Cecil, Lytchett Heath, Poole (gr. Mr. Cox). This was discovered in Rhodesia by the exhibitor about two years ago. It differs from *G. superba* in having pale yellow flowers without the slightest trace or suspicion of scarlet.

To Asplenium Trichomanes var. bipinnatum (votes, 10 for), from C. T. Druery, Esq., V.M.H., Shaa Road, Acton. A dwarf and distinct hardy spleenwort, with rich green deeply-cut fronds.

To Border Carnation 'Duchess of Roxburghe' (votes, 11 for), from Mr. J. Douglas, V.M.H., Edenside, Great Bookham. Plant of vigorous growth, with large sulphur-yellow flowers flaked with rose and purple. (Fig. 254.)

To Tea Rose 'Lady Roberts' (votes, unanimous), from Messrs. Frank Cant, Colchester. A particularly handsome variety, with long reddish copper-coloured buds, gradually passing to apricot or pale orange. The foliage is deep green and very handsome.

To Dictamnus caucasicus (votes, unanimous), from Mr. Perry, Winchmore Hill. This is an improvement on the type. It is vigorous, and bears a great profusion of large rose-coloured flowers freely streaked with crimson.

To Sedum kamtschaticum foliis variegatis (votes, unanimous), from Mr. Perry. A pretty hardy plant, differing from the type by its leaves being suffused with red and margined with yellow and creamy white; flowers yellow.

Cultural Commendation.

To Mr. W. Bain, gr. to Sir Trevor Lawrence, Bart., Burford, Dorking, for *Allium pedemontanum.*

Other Exhibits.

Lady A. Tate, Park Hill, Streatham Common (gr. Mr. W. Howe), sent flowering and fruiting branches of *Trachycarpus* (*Chamærops*) *Fortunei.*

The Hon. Evelyn Hubbard, The Rookery, Down, Kent (gr. Mr. E. S. Wiles), sent a new Coleus.

H. D. Mathias, Esq., Doone Cottage, Thames Ditton, sent Carnations.

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain), sent a very fine specimen of *Anthurium Andreanum Lawrencei.*

P. Waterer, Esq., Fawkham, Kent, sent flowers of a new Sweet Pea.

FIG. 254.—CARNATION 'DUCHESS OF ROXBURGHE.'
(*Journal of Horticulture.*)

Dr. Bonavia, Richmond Road, Worthing, sent Roses.

Mr. Early, Woodlands, Witney, sent Rose 'Elsie Early.'

From Mr. Prichard, Christchurch, Hants, came hardy flowers.

Messrs. W. Paul, Waltham Cross, sent *Rosa Wichuriana rubra.*
Mr. W. Palmer, Andover, sent Carnations.
Mr. A. W. Wade, Colchester, sent hardy flowers.
Mr. E. Davis, Beech, Alton, Hants, sent Pansies and Violas.
Messrs. Boyes, Aylestone Park, Leicester, sent Carnations.

FLORAL COMMITTEE, JULY 2, 1901.

Mr. W. MARSHALL in the Chair, and eighteen members present.

Awards Recommended :—

Gold Medal.

To Messrs. W. Paul & Son, Waltham Cross, for Roses.

First-class Certificate.

To strain of Shirley Poppies (votes, unanimous), from Rev. W. Wilks, Shirley Vicarage, Croydon. A full description and history of the Shirley Poppies is given by the raiser in vol. xxv. p. 161. The colour of some of the flowers exhibited showed a very appreciable admixture of yellow.

Award of Merit.

To Scolopendrium vulgare sagittato-cristatum (votes, 8 for, 2 against), from C. T. Druery, Esq., V.M.H., 11 Shaa Road, Acton. Unlike the common Hart's-tongue Fern, the fronds of this variety are remarkable for the prominent lobes at the base and bold crestings at the apex.

To Malmaison Carnation 'Maggie Hodgson' (votes, unanimous), from Messrs. Cutbush, Highgate. Large, sweet-scented, deep maroon flowers, with broad substantial petals.

To Canna 'Miss Kate Gray' (votes, 8 for, 3 against), from Mr. H. J. Jones, Lewisham. This belongs to the Orchid-flowering section and produces a magnificent spike of orange-coloured flowers shaded with gold and vermilion.

To Spiræa astilboides 'Silver Sheath' (*S. astilboides* × *Astilbe Thunbergii*) (votes, unanimous), from Mr. H. J. Jones, Lewisham. The long erect terminal panicles are very strong, and bear an abundance of small blush-coloured flowers.

To H. P. Rose 'Bellefleur' (votes, 9 for, 3 against), from Mr. Prince, Longworth, Berks. The flowers of this lovely variety remind one of 'Carmine Pillar.' They are semi-double, sweet-scented, carmine passing to rose, and very enduring.

To Pink 'Mrs. H. Young' (votes, 11 for, 4 against), from Mr. H. Young, Cheshunt. Rose-coloured flowers of medium size, with deep maroon blotches at the base of the petals.

To Delphinium 'Dorothy Daniel' (votes, 9 for, 2 against), from Messrs. Kelway, Langport, Somerset. A fine spike of large single bluish-purple flowers, with a cream white centre.

Other Exhibits.

The Bishop of Richmond, Beechwood, Driffield, sent a very pretty and interesting seedling Columbine with perfectly double flowers; colour rose tipped with white.

J. Lawrence Esq., Oaklands, Kenley (gr. Mr. J. Bannerman), sent a new border Carnation.

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain), sent flowers of Lilium elegans 'Lady Pelly.'

Lord Hothfield, Ashford, Kent (gr. Mr. Craik), sent Lobelia 'Hothfield Gem,' a variety with double flowers.

H. T. Pitt, Esq., Rosslyn, Stamford Hill, sent Hippeastrum procerum (*syn. Amaryllis procera.*)

Mrs. Backhouse, Sutton Court, Hereford, sent a seedling Lily.

F. Bonney, Esq., Rugeley, sent Roses.

Dr. Wilson, St. Andrews, sent hybrid Passion-flowers raised between *Passiflora* 'Constance Elliott' and *P. alba.* See Hybrid Conference Report, R.H.S. Journal, vol. xxiv. p. 166.

From Messrs. Barr, Covent Garden, came seven varieties of Delphiniums.

Mr. W. Camm, gr. to Captain Forester, Battle Abbey, sent flowers of *Carpenteria californica* and *Watsonia iridifolia.*

Messrs. Cutbush, Highgate, sent Carnations.

Mr. James Douglas, V.M.H., Great Bookham, Surrey, sent Carnations and Pinks.

From Messrs. Veitch, Chelsea, came Roses and hardy flowers.

Mr. Young, Cheshunt, sent a collection of Pinks.

Messrs. Kelway, Langport, Somerset, sent Delphiniums.

ROSE SHOW, July 2, 1901.

Judges.

Classes 1, 3.—Mr. E. Mawley, Rev. J. H. Pemberton, Mr. C. J. Salter.
Classes 2, 4, 17, 19.—Mr. C. E. Cant, Mr. G. Paul.
Classes 5, 6, 7, 15.—Mr. A. W. Paul, Mr. A. Turner.
Classes 8, 10, 11, 12, 13.—Mr. A. Prince, Mr. W. D. Prior.
Class 14.—Mr. G. W. Cook, Rev. F. Page-Roberts.
Classes 9, 16, 18.—Mr. O. G. Orpen, Rev. F. R. Burnside.

Mixed Varieties.

Class 1.—24 single trusses, distinct. (Open.)
First Prize, £3; Second, £2.

1. Messrs. B. R. Cant, Colchester.
2. Messrs. Prior, Colchester.

Class 2.—18 single trusses, distinct. (Amateurs.)
First Prize, £3; Second, £2.

1. O. G. Orpen, Esq., West Bergholt, Colchester.
2. Rev. J. H. Pemberton, Havering-atte-Bower, Essex.

Extra. Mrs. Haywood, Woodhatch, Reigate.

Class 3.—18 single trusses, distinct. (Open.)
First Prize, £2; Second, £1. 10*s*.

1. Mr. C. Turner, Slough.
2. Mr. G. Prince, Longworth, Berks.

Class **4.**—12 single trusses, distinct. (Amateurs.)

First Prize, £2; Second, £1.

1. T. Halsted, Esq., Oak Lodge, Reigate.
2. F. Wellesley, Esq., Westfield, Woking.

Class **5.**—6 single trusses, distinct. (Amateurs.)

First Prize, £1; Second, 15*s.*

1. G. H. Baxter, Esq., Hutton Park, Brentwood.
2. J. T. Thompson, Esq., Oak Lane, Bounds Green.

Class **6.**—9 single trusses of any one variety of H. P., H. T., or H. B. (Amateurs.)

First Prize, £1; Second, 15*s.*

1. Mrs. Haywood.
2. Rev. J. H. Pemberton.

Class **7.**—6 single trusses of any one variety of H. P., H. T., or H. B. (Amateurs.)

First Prize, 15*s.*; Second, 10*s.*

1. John Bateman, Esq., Rosevale, Archway Road, N.W.
2. Rev. F. Page-Roberts, Halstead, Kent.

TEAS AND NOISETTES.

Class **8.**—18 single trusses, not less than 12 varieties or more than 2 trusses of any one variety. (Amateurs.)

First Prize, £3.

1. O. G. Orpen, Esq.

Class **9.**—18 single trusses, distinct. (Open.)

First Prize, £2. 10*s.*; Second, £1. 10*s.*

1. Mr. G. Prince.
2. Messrs. Prior.

Class **10.**—12 single trusses, not less than 9 varieties or more than 2 trusses of any one variety. (Amateurs.)

First Prize, £1. 10*s.*; Second, £1.

1. E. M. Bethune, Esq., Denne Park, Horsham.
2. Rev. F. R. Burnside, Great Stambridge, Rochford, Essex.

Extra. Rev. F. Page-Roberts.

Class **11.**—6 single trusses, not less than 4 varieties. (Amateurs.)

First Prize, £1; Second, 15*s.*

1. Miss Beatrice H. Langton, Raymead, Hendon.
2. G. A. Hammond, Esq., Cambrian House, Burgess Hill, Sussex.

Class **12.**—9 single trusses of any one variety. (Amateurs.)

First Prize, £1; Second, 15*s.*

1. O. G. Orpen, Esq.
2. G. H. Baxter, Esq.

Class **13.**—6 single trusses of any one variety. (Amateurs.)

First Prize, £1; Second, 15*s.*

1. E. M. Bethune, Esq.
2. Rev. F. R. Burnside.

GARDEN ROSES. (Fig. 255.)

Class 14.—36 distinct varieties, not less than 3 trusses of each. (Open.) Space occupied by exhibit not to exceed 10 feet by 3 feet.

First Prize, £3 ; Second, £2.

1. Messrs. Paul & Son, Cheshunt.
2. Messrs. Frank Cant, Colchester.

FIG. 255.—CHINA ROSES AND THE OLD FRINGED WHITE PINK. (*The Garden.*)

Class 15.—18 distinct varieties, not less than 3 trusses of each. (Amateurs.) Space occupied by exhibit not to exceed 6 feet by 3 feet.

No entry.

Exhibition Roses in Vases.

Mixed Varieties.

Class **16.**—9 distinct varieties (to include not more than 4 varieties of Teas or Noisettes), 7 trusses of each. All Roses mentioned in the National Rose Society's Catalogue of Garden Roses to be excluded (space occupied by exhibit not to exceed 5 feet by 4 feet). Exhibits to be staged in 9 vases. (Open.)

First Prize, £3 ; Second, £2.

1. Mr. G. Prince.
2. Messrs. B. R. Cant.

Class **17.**—6 distinct varieties (to include not more than 3 varieties of Teas or Noisettes), 5 trusses of each. All Roses mentioned in the National Rose Society's Catalogue of Garden Roses to be excluded (space occupied by exhibit not to exceed 3 feet 6 inches by 4 feet). Exhibits to be staged in 6 vases. (Amateurs.)

First Prize, £3.

1. Rev. J. H. Pemberton.

Teas and Noisettes.

Class **18.**—6 distinct varieties, 7 trusses of each. All Roses mentioned in the National Rose Society's Catalogue of Garden Roses to be excluded (space occupied by exhibit not to exceed 3 feet 6 inches by 4 feet). Exhibits to be staged in 6 vases. (Open.)

First Prize, £2 ; Second, £1. 10*s.*

1. Mr. G. Prince.
2. Messrs. B. R. Cant.

Class **19.**—6 distinct varieties, 5 trusses of each. All Roses mentioned in the National Rose Society's Catalogue of Garden Roses to be excluded (space occupied by exhibit not to exceed 3 feet 6 inches by 4 feet). Exhibits to be staged in 6 vases. (Amateurs.)

First Prize, £2.

1. O. G. Orpen, Esq.

LILY CONFERENCE AT CHISWICK, July 16, 17, 1901.

Floral Committee.

Mr. W. Marshall in the Chair, and twenty-two members present.

Awards Recommended:—

Gold Medal.

To Messrs. Wallace, Colchester, for a superbly magnificent collection of Lilies, containing specimens of a greater number of species and varieties than have probably ever at any time been brought together.

Silver-gilt Flora Medal.

To Percy Waterer, Esq., Fawkham, Kent, for fifty-five varieties of Sweet Peas.

To Messrs. Jas. Veitch, Chelsea, for hardy Nymphaeas and Lilies.

Silver-gilt Banksian Medal.

To Mr. Perry, Winchmore Hill, for hardy flowers.

Silver Flora Medal.

To Mr. J. Russell, Richmond, for stove and greenhouse plants.

Silver Banksian Medal.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Messrs. Fromow, Chiswick, for Japanese Maples and Lilies.

To Messrs. Ware, Feltham, for hardy flowers.

Award of Merit.

To Lilium Burbanki (votes, 6 for, 4 against), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain); G. S. Patey, Esq., Newton Abbot; Messrs. Wallace, Colchester; and Mr. Perry, Winchmore Hill. There are at least two forms of *L. Burbanki* in cultivation. Hybrids were raised by Mr. Luther Burbank, of California, between *L. pardalinum* and *L. Washingtonianum*, which appear to have been put into commerce without sufficient selection. The flowers of one form are of a rich deep yellow spotted with crimson, the upper half of each petal stained with brownish crimson. Another has much paler flowers not unlike those of *L. pardalinum*, and much smaller than those of what should henceforth alone be recognised as the true *L. Burbanki.*

To Border Carnation 'Ensign' (votes, 6 for, 4 against), from Mr. Douglas, V.M.H., Edenside, Great Bookham. A magnificent variety, with large substantial and fragrant pure white flowers.

To Border Carnation 'Seymour Corcoran' (votes, 11 for, 3 against), from Mr. Douglas. A medium-sized flower, with stout round yellow petals touched with a deeper shade.

To Campanula lactiflora cærulea (votes, unanimous), from Mr. Perry, Winchmore Hill. A grand plant for the border or wild garden, with enormous spikes of pretty lavender-blue flowers with a white centre. The flowers are small and very enduring.

To Arctotis grandis (votes, 12 for, 4 against), from Mr. A. W. Wade, Colchester. A remarkably pretty annual composite, two feet or so high, with single Chrysanthemum-like flowers about three inches across. The ray florets are white, touched with lilac, with a prominent band of yellow near the raised mauve-coloured disc. The reverse of the petals is deeply stained with lilac, and the flowers are borne on stout stems and close up at night. A sunny position should be selected for this South African annual. (Fig. 256.)

To Lilium concolor coridion (votes, unanimous), from Messrs. Wallace, Colchester. A dainty little Lily, scarcely more than one foot high, with slender stems, narrow bright green leaves, and small rich yellow flowers, freely spotted with crimson on the lower half of the segments.

To Candytuft 'Rose Cardinal' (votes, unanimous), from Messrs. Watkins & Simpson, Tavistock Street. Plants of compact bushy habit; very free-flowering; flowers rose.

Other Exhibits.

From E. H. W. Rossiter, Esq., High Road, Chiswick, came three baskets of flowers.

FIG. 256.—ARCTOTIS GRANDIS. (*The Garden.*)

G. S. Patey, Esq., Newton Abbot, sent a small collection of Lilies.

H. P. Sturgis, Esq., Givons, Leatherhead, sent flowers of a vigorous growing form of *Gaillardia grandiflora* named '*robusta*.'

Mr. A. G. Hookings, Oldown House, Tockington, Glos., sent flowers of Carnations 'Frederica' and 'Duchess of Beaufort.' The Committee asked to see a plant of the last named.

G. Yeld, Esq., Clifton Cottage, York, sent flowers of his seedling Hemerocallis 'Pioneer.'

H. Jonas, Esq., Whyteleafe Surrey, sent seven varieties of Lilies.

Percy Waterer, Esq., Fawkham, Kent, sent four new varieties of Sweet Peas. It was requested that seed be sent to Chiswick.

Captain Savile Reid, Yalding, Kent, sent Lilies.

J. S. Satterthwaite, Esq., Silverton, Kenley, sent Border Carnations.

G. H. Hadfield, Esq., Moraston House, Ross (gr. Mr. J. Rick), sent a new Begonia.

James Snow Whall, Esq., Worksop, sent a photograph of Lilium Parryi 'The Leopard' (*L. Parryi* ♀ × *L. pardalinum* ♂).

Mr. Jones, Hartpury House Gardens, Gloucester, sent Carnations.

Mr. E. Laidlaw, Sunderland, sent a group of Pelargonium 'Kilmeny,' a sport from P. 'Madame Thibaut.'

Mr. Douglas, V.M.H., Edenside, Great Bookham, sent Carnations and Picotees.

Floral Committee, July 30, 1901.

Mr. W. Marshall in the Chair, and twenty-one members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Mr. Perry, Winchmore Hill, for Nymphæas.

To Messrs. Sutton, Reading, for Gloxinias, raised from seed sown in January 1901.

Silver-gilt Banksian Medal.

To Messrs. Paul, Cheshunt, for Roses and Phloxes.

To Messrs. Cannell, Swanley, for Begonias.

To Messrs. Webb & Brand, Saffron Walden, for Hollyhocks.

Silver Flora Medal.

To Messrs. Paul, Waltham Cross, for Phloxes.

Silver Banksian Medal.

To Mr. May, Upper Edmonton, for Campanulas.

To Messrs. Wallace, Colchester, for Lilies and hardy flowers.

To Mr. Jones, Lewisham, for flowering and foliage plants.

To Mr. Wade, Colchester, for Sweet Peas.

Award of Merit.

To Montbretia germania (votes, unanimous), from J. T. Bennett-Poë, Esq., Holmewood, Cheshunt, and Messrs. Paul, Cheshunt. Large orange-scarlet flowers with a yellow centre, borne on wiry, much-branched stems. The plant is vigorous in growth and a decided acquisition.

To Gypsophila paniculata flore pleno (votes, unanimous), from Messrs. Thomson, Wimbledon. This was found in a bed of seedlings of *G. paniculata* sown in 1898. It is free in growth, and differs from the type only by reason of its perfectly double pure white flowers.

To Rosa polyantha 'Eugenie Lamesch' (votes, unanimous), from Messrs. Paul, Cheshunt. Small canary-yellow double flowers suffused with apricot and borne in large clusters.

To the strain of Gloxinias (votes, 12 for, 5 against), from Messrs. Sutton, Reading. A splendid strain, with large, variously coloured, and in many cases freely-spotted flowers. The plants were raised from seed sown January 23, 1901.

To Border Carnation 'Heroine' (votes, 8 for, 6 against), from Mr. C. Turner, Slough. Large well-formed flowers, pale lemon, margined and splashed with pink and purple.

To Border Carnation 'Lady Bristol' (votes, unanimous), from Mr. Turner. Large pale yellow flowers, margined and flaked with red.

To Border Carnation 'Wasp' (votes, 10 for, 2 against), from Mr. Turner. Handsome lemon-yellow flowers slightly edged with deep red.

To Border Carnation 'Chas. Martel' (votes, 7 for, 5 against), from Mr. Turner. Large pale yellow flowers heavily flaked and edged with deep red.

Other Exhibits.

Miss Willmott, M.V.H., Warley, sent Campanula 'Warley.'

Sydney Morris, Esq., Wretham Hall, Thetford, sent a new Border Carnation.

From Miss Easterbrook, Fawkham, Kent, came baskets and epergnes of flowers.

J. Thorley, Esq., Ringdale, Faringdon, Berks (gr. Mr. F. Astley), sent a seedling Carnation.

Mr. Calkin, Rose Cottages, Winchmore Hill, sent Carnations.

Messrs. R. Veitch, Exeter, sent flowers of a new species of Honeysuckle, *Lonicera Hildebrandiana*.

Messrs. Hobbie, Dereham, Norfolk, sent *Sambucus racemosa tenuifolia*, a variety with prettily cut leaves.

Messrs. Cooper Taber, Southwark Street, London, sent Petunia 'Silver Star.'

Messrs. Jas. Veitch, Chelsea, sent greenhouse Rhododendrons.

Messrs. Barr, Covent Garden, sent hardy flowers.

Messrs. Peed, West Norwood, sent Achimenes.

Messrs. Ware, Feltham, sent hardy flowers.

Mr. C. Turner, Slough, sent Carnations and Picotees.

Floral Committee, August 13, 1901.

Mr. W. Marshall in the Chair, and sixteen members present.

Awards Recommended :—

Gold Medal.

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.), for forty-two varieties of Water-lilies.

Silver-gilt Flora Medal.

To Messrs. Kelway, Langport, for Gladioli.

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for Helianthus, Tritomas, and hardy shrubs.

To Mr. Russell, Richmond, for Codiæums (Crotons).

To Messrs. Jones, Shrewsbury, for Sweet Peas and Dahlias.

To Mr. Mortimer, Farnham, for Dahlias.

Silver Banksian Medal.

To Mr. Perry, Winchmore Hill, for hardy flowers and Water-lilies.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.
To Messrs. Wallace, Colchester, for hardy flowers and Lilies.

Bronze Flora Medal.

To Mrs. Davies-Evans, Highmead, Llanybyther, S. Wales, for Water-lilies.
To R. O. Foster, Esq., Sutton, Surrey (gr. Mr. Simpson), for Sweet Peas.
To Messrs. Laing, Forest Hill, for Tuberous Begonias.

FIG. 258.—PELARGONIUM ENDLICHERIANUM. (*Gardeners' Chronicle.*)

First-class Certificate.

To Lonicera Hildebrandiana (votes, 11 for), from Rev. H. Ewbank, St. John's, Ryde; and Messrs. R. Veitch, Exeter. A distinct and handsome Honeysuckle, but, unfortunately, hardy only in favoured localities. It is a native of Burma, and was discovered by Sir H. Collett thirteen years ago. It is of vigorous growth, with large opposite green leaves, and in suitable positions bears an abundance of very large and very long tubular orange-yellow fragrant flowers.

To Sagittaria japonica flore pleno (votes, 9 for), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. J. Hudson, V.M.H.). A hardy free-growing water plant, with deep green sagittate leaves and small perfectly double cream-white flowers, like small Carnations arranged in whorls on tall stout spikes. (Fig. 257.)

To Sarracenia Dormeri (votes, 10 for, 2 against), from Messrs. R. Veitch, Exeter. This was imported as *S. purpurea*, but it is quite distinct from that species. It may, however, be a natural hybrid between

FIG. 259.—PELARGONIUM ENDLICHERIANUM. (*The Garden.*)
(Showing the habit of the plant.)

S. purpurea and *S. flava*. The green pitchers are nearly a foot long, and the broad green hood is veined and shaded with crimson.

Award of Merit.

To Pelargonium Endlicherianum (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). A perfectly hardy plant in the South of England; introduced from the Western Taurus forty-six years ago. It has cordate, serrated, woolly green leaves, and produces a mass of rose-coloured flowers, with conspicuous purplish-crimson veins, on stems eighteen inches high. (Figs. 258, 259.)

To Amaryllis Belladonna maxima (votes, 10 for, 5 against), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). The flowers of this variety appear much earlier than those of the type; they are also of a deeper shade of pink.

To Gladiolus Lemoinei 'Lumineux' (votes, unanimous), from Mr. Prichard, Christchurch, Hants. A large-flowered variety, with broad cream-coloured segments suffused with crimson; the basal portion of the lower segments heavily blotched with crimson.

To Gladiolus Lemoinei 'Duc d'Abruzzi' (votes, unanimous), from Mr. Prichard, Christchurch. Large lilac-coloured flowers, streaked with purplish-blue; the lower segments bright purple, shaded with violet.

To Cyrilla racemiflora (votes, unanimous) from Messrs. Jas. Veitch, Chelsea. An exceedingly rare shrub, introduced from the Southern United States in 1765. It is rather sparsely branched, has bright green lanceolate leaves, two inches long, and bears tiny white flowers in slender drooping racemes, five inches long, in whorls on the previous year's wood.

To Bedding Carnation 'Sir R. Waldie-Griffith' (votes, 10 for, 1 against), from Messrs. Laing & Mather, Kelso-on-Tweed. A remarkably bright and distinct variety, with large shapely rich orange-scarlet sweet-scented flowers.

To Canna 'Mrs. G. A. Strohlein' (votes, unanimous), from Messrs. Cannell, Swanley. A splendid variety, with large substantial crimson flowers; leaves bronze-purple.

Other Exhibits.

A. Worsley, Esq., Isleworth (gr. Mr. J. Miles), sent Hippeastrums and some seedling Coleus.

W. P. Thomson, Esq., Bollo Lane, Chiswick, sent Phlox 'Mrs. Jenkins.'

Messrs. Cheal, Crawley, sent Cactus Dahlias and hardy Robinias.

From Messrs. Dobbie, Rothesay, came a collection of Zinnias.

Mr. A. W. Wade, Colchester, sent a group of hardy flowers.

Mr. W. Baxter, Woking, sent Cactus Dahlias.

Messrs. Ware, Feltham, sent hardy flowers.

Messrs. Johnson, Boston, sent some *Helianthus cucumerifolius* hybrids.

Floral Committee, August 27, 1901.

Mr. W. Marshall in the Chair, and eighteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Mr. Russell, Richmond, for Alocasias.

Silver-gilt Banksian Medal.

To Messrs. Barr, Covent Garden, for Gladioli and hardy flowers.

Silver Flora Medal.

To Messrs. Laing, Forest Hill, for Caladiums.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

Silver Banksian Medal.

To Mr. Wade, Colchester, for hardy flowers.

To Messrs. Young, Milford, Godalming, for hardy Heaths.

First-class Certificate.

To Nelumbium speciosum album plenum (syn. Shiroman) (votes, unanimous), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A free-growing Japanese water plant, with large orbicular leaves and bold semi-double white flowers. (Fig. 260.)

To Nelumbium speciosum roseum plenum (votes, unanimous), from Leopold de Rothschild, Esq. This is another Japanese variety with

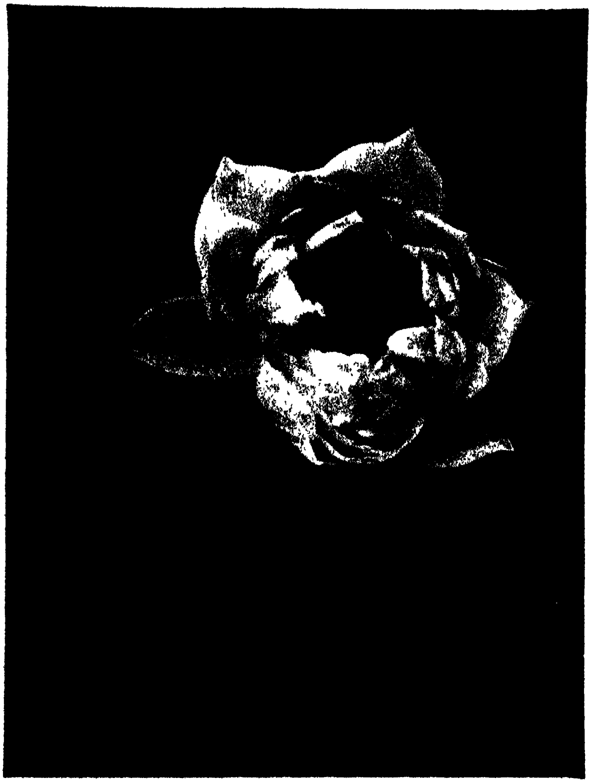


FIG. 260.—NELUMBIUM SPECIOSUM ALBUM PLENUM. (*The Garden.*

magnificent semi-double rose-pink flowers, striped and suffused with deep rose.

To Brunsvigia grandiflora (votes, unanimous), from Messrs. Paul, Cheshunt. A very uncommon bulbous plant, introduced from the Cape of Good Hope in 1829. Leaves long, flat, 2 inches broad, pale green; scape 20 inches high, terminating in an umbel of single rosy-pink bell-shaped flowers $2\frac{1}{2}$ inches long and as much across.

Award of Merit.

To Gladiolus hybridus princeps (votes, unanimous), from Sir Trevor

Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). Large scarlet flowers blotched and feathered with white. (Fig. 261.)

To Gladiolus Lemoinei 'Eclipse' (votes, 12 for, 8 against), from Mr. Prichard, Christchurch, Hants. Flowers blush white, shaded with amethyst and blotched with deep plum or port-wine colour.

FIG. 261.—GLADIOLUS HYBRIDUS PRINCEPS. (*The Garden.*)

To Gladiolus Childsii 'Columbine' (votes, 11 for), from Mr. Prichard. Large brick-red flowers flushed with brown.

To Clematis 'Ville de Lyon' (votes, unanimous), from Messrs. Barr, Covent Garden. The flowers of this charming variety are well formed, rather small, reddish-purple, with prominent white anthers.

To Acer Negundo aureum odessanum (votes, 11 for, 7 against), from Mr. Kromer, Brandon Hill, Croydon. A free-growing sport with large golden-yellow leaves flaked with green.

Other Exhibits.

Lady Ashburnham, Brooklands, Wellington, Salop, sent a new seedling Zonal Pelargonium.

A. Benson, Esq., Upper Gatton Park, Surrey (gr. Mr. W. Mancey), sent Lapagerias.

From Messrs. Cannell, Swanley, came *Kochia scoparia* and Alternantheras.

Mr. J. Bryson, Helensburgh, sent Carnation 'Dons White.'

Mr. G. St. Pierre Harris, Orpington, sent twelve seedling Dahlias.

Mr. G. Bethell, Uxbridge, sent *Pteris Bethelli.*

Messrs. Low, Enfield, sent *Hippeastrum procerum.*

Floral Committee, September 10, 1901.

Mr. W. Marshall in the Chair, and twenty-three members present.

Awards Recommended :—

Gold Medal.

To J. Gurney Fowler, Esq., Glebelands, South Woodford (gr. Mr. J. Davis), for an extensive collection of Selaginellas.

To Messrs. Cannell, Swanley, for magnificent Cactus Dahlias.

Silver Flora Medal.

To Messrs. Hill, Lower Edmonton, for choice and rare Ferns.

To Messrs. Ware, Feltham, for hardy flowers and Cannas.

To Mr. Russell, Richmond, for stove and greenhouse plants.

Silver Banksian Medal.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Messrs. W. Paul, Waltham Cross, for new Roses.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

To Messrs. Laing, Forest Hill, for Chrysanthemums and Roses.

First-class Certificate.

To Nymphæa Devoniensis (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). A tender and very beautiful hybrid Water-lily with pale pink flowers 8 inches or more across. It is a free and continuous bloomer, and the flowers exhibited were cut from a plant which had been kept out of doors since the middle of May.

To Kochia scoparia (votes, 14 for, 2 against), from Messrs. Cannell, Swanley. A very ornamental annual of good growth. It forms a freely-branched upright bushy specimen, with linear deep-green leaves and a profusion of tiny greenish flowers.

Award of Merit.

To Canna 'Reichskanzler Fürst Hohenlohe' (votes, unanimous), from Sir Trevor Lawrence, Bart. Plant of dwarf habit and very free flowering; flowers large, deep canary-yellow, the lower segment marked with crimson.

To Berberidopsis corallina (votes, 11 for, 1 against), from Lord Malcolm of Poltalloch, Lochgilphead, N.B. (gr. Mr. D. S. Melville). This lovely evergreen shrub was discovered by a Mr. Pearce in the forests of Valdivia, Chili, in 1862, and is figured in the *Bot. Mag.* tab. 5343. It is rather tender, and well deserves to be grown at the foot of a south-west wall, or even treated as a cool greenhouse shrub in cold localities. It grows freely in ordinary well-drained soil, and in autumn bears a great number of small coral-red or crimson flowers in drooping terminal racemes. Leaves alternate, oblong with a rounded base, toothed, glossy green above, paler below.

To Tree Carnation 'E. Crocker' (votes, 11 for, 5 against), from Mr. Jones, Lewisham. Sweet-scented pink flowers with slightly serrated petals, reminding one of C. 'Mrs. T. W. Lawson.'

To Helianthus tomentosus (votes, 15 for), from Messrs. Wallace, Colchester; and Mr. Perry, Winchmore Hill. A medium-sized single Sunflower with broad, deep yellow ray florets and a prominent black centre. The flowers are borne on stout pubescent stems, and the sub-cordate leaves are pubescent, especially in spring and early summer. It grows from 4 to 5 feet high. It received an award of merit under the name of *H. mollis*, but was afterwards discovered to be *H. tomentosus*.

To Tea Rose 'Salmonea' (votes, unanimous), from Messrs. W. Paul, Waltham Cross. A free-flowering variety with lovely sweet-scented, cup-shaped, rose-pink flowers, touched with pale salmon in the centre. The plant is of dwarf bushy habit.

To Tea Rose 'Madame Berkeley' (votes, 8 for, 4 against), from Messrs. Paul, Cheshunt. A charming variety with long buds, pale cream-white touched with rose-pink. It is very fragrant.

To Japanese Chrysanthemum 'Goacher's Crimson' (votes, 9 for, 4 against), from Messrs. Wells, Earlswood, Redhill. An early flowering variety with well-formed dull crimson flowers, with a golden yellow reverse.

To Japanese Chrysanthemum 'Orange Masse' (votes, 11 for, 2 against), from Messrs. Wells, Redhill. A pale orange or buff-coloured sport from the well-known 'Madame Marie Masse.'

To Phragmites communis foliis variegatis (votes, 15 for), from Messrs. Barr, Covent Garden. A vigorous growing ornamental reed, 6 feet or so high, well adapted for planting on the edges of lakes and in wild gardens. The stems are clothed with long green leaves striped with white.

To Cactus Dahlia 'Mrs. De Luca' (votes, 16 for, 1 against), from Messrs. Cheal, Crawley. A handsome variety with incurving bronzy-yellow petals suffused with fawn.

To Pompon Cactus Dahlia 'Freedom' (votes, 14 for), from Messrs. Cheal. Flowers small, rich orange-scarlet, with narrow incurving petals.

To Pompon Dahlia 'Crusoe' (votes, 11 for, 1 against), from Messrs. Cheal. Beautifully formed white flowers, deeply edged with rose.

To Cactus Dahlia 'Khaki' (votes, unanimous), from Mr. Stredwick, St. Leonards. A grand variety with broad orange-coloured petals.

To Cactus Dahlia 'Alpha' (votes, 14 for, 7 against), from Mr. Stredwick. A distinct variety with broad tapering petals, white ground spotted and flaked with crimson.

To Cactus Dahlia 'W. F. Balding' (votes, 13 for, 3 against), from Mr. Stredwick. Flowers with incurving orange-scarlet petals tipped with white.

To Cactus Dahlia 'Mrs. Winstanley' (votes, 14 for), from Mr. Stredwick. A beautiful variety with narrow bright scarlet petals touched with orange.

To Cactus Dahlia 'Richard Dean' (votes, 17 for, 3 against), from Mr. Stredwick. Large, beautifully shaped, bright orange-scarlet flowers tipped with white.

To Cactus Dahlia 'Lilac' (votes, 10 for, 4 against), from Mr. Stredwick. A dainty variety with incurving pale pink flowers, passing to white towards the tips of the petals.

To Show Dahlia 'Merlin' (votes, 8 for, 4 against), from Mr. C. Turner, Slough. Large, shapely, rich orange-scarlet flowers.

To Cactus Dahlia 'Mars' (votes, 14 for, 3 against), from Messrs. Keynes Williams, Salisbury. A splendid large-flowered variety with incurving scarlet petals faintly suffused with orange.

To Cactus Dahlia 'Gabriel' (votes, unanimous), from Messrs. Keynes Williams. A pleasing variety with narrow incurving white petals margined with scarlet.

To Cactus Dahlia 'Ophir' (votes, 12 for), from Messrs. Keynes Williams. Beautifully shaped orange-yellow flowers suffused with rose.

To Cactus Dahlia 'Genista' (votes, 14 for), from Messrs. Keynes Williams. This is another grand variety similar to the last named, but of a deeper shade of the same colour.

To Cactus Dahlia 'Mrs. H. J. Jones' (votes, unanimous), from Mr. West, Tower Hill, Brentwood. A handsome flower with large incurving rich scarlet petals heavily tipped with white.

To Cactus Dahlia 'Spotless Queen' (votes, unanimous), from Mr. West. This is undoubtedly the best white Cactus variety grown. The flowers are borne on long wiry stems, and the petals are long and incurve beautifully.

Botanical Certificate.

To Biarum eximium (syn. Ischarum eximium) (votes, unanimous), from Messrs. Wallace, Colchester. A dwarf Aroid with a dark crimson or maroon spathe 6 inches high.

Other Exhibits.

Lord Malcolm of Poltalloch, Lochgilphead, N.B. (gr. Mr. D. S. Melville), sent flowering shoots of *Eucryphia pinnatifolia* (Brush-bush), a very beautiful and uncommon deciduous shrub, with pure white flowers and

golden stamens. It is said to grow from 12 to 15 feet high in Chili, whence it was introduced twenty-one years ago. It is hardy, and flourishes in peat, loam and leaf-mould, in equal parts. Thorough drainage is essential and a sunny spot necessary in order to promote good flowering wood.

Mrs. Evans, Ford Abbey, Chard (gr. Mr. J. Crook), sent flowers of *Nerine Fothergilli major* and *Primula obconica grandiflora.*

J. Warren, Esq., Handcross Park, Crawley, Sussex (gr. Mr. A. Offer), sent a small group of *Dracæna Offeri*, a showy variety with bronze-green leaves edged with crimson.

From Captain Forester, Battle Abbey (gr. Mr. W. Camm), came flowering shoots of *Kœlreuteria paniculata*, a small deciduous tree indigenous to Northern China.

H. Raschen, Esq., Sidcup, Kent, sent *Bambusa tricolor*, which was considered to be synonymous with *Phragmites communis foliis variegatis*.

Messrs. Jas. Veitch, Chelsea, sent Gladiolus 'White Lady,' Chrysanthemum 'Princess Henry,' and Ageratum 'Princess Louise.' The Committee asked to see a plant of the last named.

From Mr. Jones, Lewisham, came a large collection of Perennial Asters (Michaelmas Daisies).

Dahlias were contributed by :—

1. Mr. C. Turner, Slough.
2. Messrs. Cheal, Crawley.
3. Messrs. Keynes Williams, Salisbury.
4. Mr. Notcutt, Woodbridge.
5. Mr. Stredwick, St. Leonards.
6. Mr. West, Brentwood.

Floral Committee, September 24, 1901.

Mr. W. Marshall in the Chair, and nineteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Hobbies, Dereham, for Dahlias.
To Messrs. W. Paul, Waltham Cross, for Roses.

Silver-gilt Banksian Medal.

To Messrs. Cheal, Crawley, for Cactus Dahlias.
To Messrs. Burrell, Cambridge, for Gladioli.
To Mr. Walker, Thame, for Dahlias.
To Messrs. Cannell, Swanley, for Cannas.

Silver Flora Medal.

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. James Hudson, V.M.H.), for Celosias.
To Mr. West, Brentwood, for Dahlias.
To Mr. Russell, Richmond, for Ivies

To Messrs. Stredwick, St. Leonards, for Cactus Dahlias.

To Mr. Perry, Winchmore Hill, for hardy flowers.

Silver Banksian Medal.

To Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kolf), for Celosias.

To Mr. Treseder, Cardiff, for Dahlias.

To Messrs. Peed, West Norwood, for Begonias.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Mr. Mortimer, Rowledge, Farnham, for Cactus Dahlias.

To Messrs. Cutbush, Highgate, for a group of plants.

To Messrs. Paul, Cheshunt, for Roses.

To Messrs. Ware, Feltham, for Dahlias.

Bronze Flora Medal.

To Mrs. Campion, Trumpets Hill, Reigate (gr. Mr. J. Fitt), for Roses.

Award of Merit.

To Dædalacanthus Wattii (votes, unanimous), from Colonel Beddome, F.L.S., Sispara, West Hill, Putney. A free-flowering stove or greenhouse plant, said to be quite new. The plant exhibited was about 2 ft. 6 in. high and of good growth. Leaves opposite, deep green, set on long petioles; flowers flat, violet-blue, three-quarters of an inch across, borne on rather stout spikes at the apex of the main and side growths.

To Quercus dentata (syn. *Q. Daimio*) (votes, unanimous), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A very uncommon Japanese deciduous Oak, with very large, rich green, obovate, deeply-lobed leaves, heavily suffused with brown and crimson in autumn. The tree is of medium height, and useful for decorative planting. A magnificent plant if only it proves hardy.

To Chrysanthemum 'Horace Martin' (votes, 9 for), from Mr. Martin, Leighton Buzzard. A lovely yellow sport from the free-flowering crimson 'Madame Marie Masse.'

To Decorative Chrysanthemum 'Godfrey's Pet' (votes, 7 for), from Mr. Godfrey, Exmouth. Plant of dwarf sturdy habit; moderately free-flowering; flowers with drooping petals, rich canary-yellow, with a paler reverse.

To Liatris scariosa magnifica (votes, 11 for, 3 against), from Mr. Perry, Winchmore Hill. This grows about 2 ft. high, and differs from the type by reason of its more branching habit, larger and brighter-coloured flowers.

To Colchicum Sibthorpii (votes, 10 for, 3 against), from Messrs. R. Veitch, Exeter. A remarkably fine flower, with long pointed purple-lilac petals stained with white. It is a native of Greece and Armenia, and was introduced to this country in 1890. Colchicums are pretty autumn-flowering bulbs, well adapted for planting in masses in the grass They prefer a rather moist soil, and should be planted about 3 in. deep.

To Tree Carnation 'Mrs. S. J. Brooks' (votes, 6 for, 5 against), from Messrs. Cutbush, Highgate. Plant of sturdy habit and very floriferous; sweet-scented flowers of medium size with serrated edges, reminding one of C. 'Mrs. Moore.'

To Pennisetum Rueppellianum (votes, unanimous), from Messrs. Cannell, Swanley. A very graceful grass, nearly 3 ft. high, with narrow arching deep-green leaves, and a long slender, dark, brown inflorescence.

To Cactus Dahlia 'Aunt Chloe' (votes, unanimous), from Messrs. Stredwick, St. Leonards. Large, handsome flowers, with incurving pointed petals; colour, deep maroon suffused with purple.

To Cactus Dahlia 'Clara G. Stredwick' (votes, unanimous), from Messrs. Stredwick. A pleasing variety, with narrow, incurving, very pale salmon-coloured petals, with a yellowish base.

To Cactus Dahlia 'Goldfinch' (votes, unanimous), from Messrs. Stredwick. Lovely old-gold-coloured flowers with incurving petals.

To Single Dahlia 'Beauty of Sevenoaks' (votes, unanimous), from Mr. Seale, Sevenoaks. Large well-formed orange-yellow flowers, streaked and shaded with scarlet, and tipped with creamy-white.

To Single Dahlia 'Robin Adair' (votes, unanimous), from Mr. Seale, Sevenoaks. A beautiful medium-sized flower, with well-rounded rosy-carmine petals, heavily tipped with white.

To Single Dahlia 'Maid of Athens' (votes, unanimous), from Mr. Seale. Shapely yellow flowers, heavily tipped with white.

To Miniature Cactus Dahlia 'Nana' (votes, unanimous), from Mr. C. Turner, Slough. Small neat scarlet flowers, touched with orange towards the base of the petals.

To Pompon Dahlia 'Mildred' (votes, unanimous), from Mr. Turner. Beautifully shaped orange-red flowers, borne on long stiff stems.

To Pompon Dahlia 'Hesperia' (votes, unanimous), from Mr. Turner. Small yellow flowers, edged with rosy-red.

To Cactus Dahlia 'Mrs. A. F. Perkins' (votes, unanimous), from Messrs. Cheal, Crawley. A splendid variety with incurving primrose-yellow petals, the outer ones nearly white.

To Cactus Dahlia 'Sailor Prince' (votes, unanimous), from Messrs. Hobbies, Dereham. Medium-sized fiery-scarlet flowers, touched with crimson.

To Cactus Dahlia 'Mrs. Ed. Mawley' (votes, unanimous), from Messrs. Burrell, Cambridge. Large deep yellow flowers, with incurving pointed petals.

To Cactus Dahlia 'Clio' (votes, unanimous), from Messrs. Burrell, Cambridge. Rich orange-yellow flowers, flushed with salmon.

To Cactus Dahlia 'Mrs. H. A. Needs' (votes, unanimous), from Mr. Baxter, Woking. Flowers crimson flushed with purple, borne on long wiry stems.

To Cactus Dahlia 'General Buller' (votes, unanimous), from Messrs. Keynes Williams, Salisbury. A beautiful variety, with long incurving purplish-crimson petals, tipped with blush-white.

To Cactus Dahlia 'Mrs. Clarke' (votes, unanimous), from Messrs. Keynes Williams. Large bronzy-yellow flowers, tipped and shaded with salmon.

To Cactus Dahlia 'Ringdove' (votes, unanimous), from Messrs. Keynes Williams. Beautifully formed pale orange-scarlet flowers, tipped and slightly suffused with rose.

Award of Merit.

To Odontoglossum × Adrianæ Lindeniæ (votes, unanimous), from J. Leemann, Esq., Heaton Mersey (gr. Mr. A. Edge). Flower white, densely spotted with chocolate.

To Odontoglossum crispum 'The Nizam' (votes, unanimous), from J. Leemann, Esq. A fine variety with white flowers tinged with rose and spotted with purple.

To Odontoglossum crispum 'Abner Hassell' (votes, unanimous), from Messrs. Stanley Ashton, Southgate. Flowers large; petals broad, bearing large reddish-brown blotches.

FIG. 263.—ODONTOGLOSSUM × WILCKEANUM 'GOLDEN QUEEN.' (*Journal of Horticulture.*)

To Cattleya Mendelii gigantea (votes, 9 for, 8 against), from Henry Little, Esq., Baronshalt, Twickenham (gr. Mr. Howard). A very large pale-tinted flower.

To Odontoglossum crispum 'Captain Hoeken' (votes, 8 for), from Monsieur Florent Claes, Brussels. Flower white, tinged with rose, and spotted with purple.

To Lælio-Cattleya × 'Ivernia' (*L.-C.* × *callistoglossa* × *L. tenebrosa*), (votes, unanimous), from Messrs. Charlesworth, Heaton, Bradford. Flowers rose-colour; lip-veined with purplish crimson.

To Cattleya Mossiæ dulcis (votes, unanimous), from Sir Frederick Wigan, Bart. Flower large; sepals and petals light rose; lip-marked with dark ruby-red, centre orange.

To Cattleya Mendelii 'Mrs. Tunstill' (votes, unanimous), from Messrs. Hugh Low. Allied to *C. M. Morganiæ.* Flower blush-white, with a purple blotch in the centre of the lip.

Botanical Certificate.

To Cypripedium guttatum, from H. J. Elwes, Esq., F.R.S., Colesborne. A pretty dwarf plant, with solitary white flowers blotched with purple.

Cultural Commendation.

To Mr. W. Stevens, gr. to W. Thompson, Esq., for a grand plant of *Odontoglossum* × *Wilckeanum* 'Golden Queen,' with a fine spike of over twenty flowers.

Other Exhibits.

Sir Frederick Wigan, Bart., showed a fine group in which were many rare varieties.

J. Leemann, Esq., showed a fine collection of rare Odontoglossums.

J. Rutherford, Esq., showed *Odontoglossum crispum deliciosum* and other varieties.

Capt. Holford, C.I.E., Westonbirt (gr. Mr. A. Chapman), showed *Odontoglossum crispum* 'Ian,' and *O.* × *Adrianæ* 'Mrs. Menzies,' both fine spotted varieties.

The Hon. Walter Rothschild, M.P., sent *Lælio-Cattleya* × 'Dido' (*C. Skinnerii* × *L. cinnabarina*); and a *Lælio-Cattleya* × ? *C. aurea* × *L. cinnabarina.*

Ludwig Mond, Esq. (gr. Mr. J. O. Clarke), staged an effective group.

Messrs. F. Sander had a grand group of rare Orchids.

Messrs. Jas. Veitch showed hybrid Lælio-Cattleyas and Cypripediums.

Messrs. B. S. Williams exhibited a fine group.

Mr. Jas. Cypher, Messrs. Charlesworth, Messrs. Hugh Low, and Messrs. Stanley Ashton had groups of Orchids.

M. Florent Claes, Brussels, showed good Odontoglossums.

M. Linden, Brussels, sent a selection of *Phalænopsis amabilis borneensis.*

M. Jules Hye de Crom, Ghent, showed *Odontoglossum crispum Idolæ.*

M. A. A. Peeters, Brussels, showed *Odontoglossum crispum* 'Victoria Regina' and others.

Messrs. Janssens & Putzeys, Antwerp, staged a collection of Odontoglossums.

Leopold de Rothschild, Esq., Gunnersbury Park (gr. Mr. Reynolds), exhibited a splendid group of *Vanda teres.*

Orchid Committee, June 4, 1901.

Mr. Harry J. Veitch in the Chair, and fifteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for a very fine group of Orchids.

ORCHID COMMITTEE.

TEMPLE SHOW, MAY 22, 1901.

Mr. HARRY J. VEITCH in the Chair, and twenty-two members present.

Awards Recommended :—

First-class Certificate.

To Lælio-Cattleya × 'Edgar Wigan' (L.-C. × 'Aphrodite' ♀ *L. Digbyana* ♂) (votes, unanimous), from Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young). A very fine hybrid,

FIG. 262.—ODONTOGLOSSUM CRISPUM VAR. 'ANNIE.' (*Journal of Horticulture.*)

closely resembling *L.-C.* × *Digbyano-Mendelii*, but with a purple base and rose-purple tinted front to the lip.

To Odontoglossum crispum 'Annie' (votes, unanimous), from H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood). Flower large, white tinted with purple, and evenly spotted with claret-purple. A.M. May 26, 1897. (Fig. 262.)

To Odontoglossum × Wilckeanum 'Golden Queen' (votes, unanimous), from W. Thompson, Esq., Walton Grange, Stone (gr. Mr. W. Stevens). Flower broad in all its parts, pale yellow, heavily blotched with brown. It received an A.M. November 10, 1896, as *O. crispum* 'Golden Queen,' but the development of the crest is considered to prove hybridity. (Fig. 263.)

To Cactus Dahlia 'Columbia' (votes, unanimous), from Messrs. Keynes Williams. Large scarlet flowers, heavily tipped with white.

To Cactus Dahlia 'Clarence Webb' (votes, unanimous), from Messrs. Keynes Williams. Large, handsome, orange-coloured flowers, heavily shaded with salmon.

To Show Dahlia 'Standard' (votes, unanimous), from Mr. G. St. Pierre Harris, Orpington. Large, substantial, maroon flowers, tipped with purple.

Other Exhibits.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon), sent flowers of *Sagittaria montevidensis* and *Pontederia montevidensis* from an open-air pond.

J. T. Bennett Poe, Esq., Holmewood, Cheshunt (gr. Mr. Downes), sent *Nerine Carréi.*

From J. Innes Rogers, Esq., Raggleswood, Chislehurst, came large fruits of *Xanthoceras sorbifolia*, a rather uncommon deciduous shrub or small tree bearing an abundance of white flowers streaked with red. It is of easy culture, grows about 12 feet high, and was introduced from China in 1870.

W. H. Myers, Esq., Swanmore Park, Bishop's Waltham (gr. Mr. E. Molyneux, V.M.H.), sent Aster 'Margaret Matthews.'

From A. Pears, Esq., Spring Grove, Isleworth (gr. Mr. W. Farr), came a small group of highly coloured Codiaeums (Crotons).

Mr. W. Davies, Bromham House Gardens, Bromham, Bedford, sent a sport from Pelargonium 'Master Christine.'

Messrs. Crane & Clarke, March, sent two varieties of Tree Carnations. The Committee asked to see these again.

Messrs. Low, Enfield, also sent Carnations. The Committee asked to see these again.

Messrs. R. Veitch, Exeter, sent *Scabiosa caucasica magnifica* and *Aster canescens.*

Messrs. Jas. Veitch, Chelsea, sent *Diascia Barberae*, a pretty annual introduced from South Africa 30 years ago.

Mr. Englemann, Saffron Walden, sent a sport from Chrysanthemum 'Madame Zephir Lionnet.'

Messrs. Wallace, Colchester, sent hardy flowers.

Messrs. Wells, Earlswood, Redhill, sent Chrysanthemums.

Dahlias were exhibited by :—

1. Edward Mawley, Esq., Rosebank, Berkhamsted.
2. Messrs. Keynes Williams, Salisbury.
3. Mr. W. Parrott, Montreal, Sevenoaks.
4. Mr. G. St. Pierre Harris, Orpington.
5. Mr. M. V. Seale, Sevenoaks.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a fine group of Odontoglossums and other Orchids.

Silver Flora Medal.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a good group of Orchids.

To H. F. Simonds, Esq., Beckenham (gr. Mr. Geo. Day), for a group of Odontoglossums, Cattleyas, &c.

To Messrs. Jas. Veitch, Chelsea, for a fine group, principally hybrids.

To A. H. Smee, Esq., Carshalton (gr. Mr. Humphreys), for a group of Cattleyas.

To Messrs. Stanley Ashton, Southgate, for a group of *Cattleya Mossiæ.*

To Messrs. Hugh Low, for a group of Orchids.

Silver Banksian Medal.

To Messrs. B. S. Williams, for a group of Orchids.

Award of Merit.

To Odontoglossum crispum punctatum 'Rosslyn var.' (votes, 7 for, 4 against), from H. T. Pitt, Esq. Flowers white, tinged with rose, and prettily marked with small rose-purple spots.

To Odontoglossum × loochristyense 'Lord Milner' (votes, unanimous), from Thomas Baxter, Esq., Oakfield, Morecambe (gr. Mr. R. Roberts). Flower large, white on the inner portions of the segments, yellow on the outer portions; sepals and petals blotched with light brown.

To Cattleya Mossiæ, 'Mrs. F. W. Ashton' (votes, 8 for), from Messrs. Stanley Ashton. Flower large, pure white, with pale yellow disc to the lip, in the front portion of which is a pale pink blotch.

Cultural Commendation.

To Mr. T. Blackmore, gr. to R. Hay Murray, Esq., Springfield, Great Marlow, for a wonderful specimen of *Dendrobium thyrsiflorum* with many flower-spikes.

Other Exhibits.

H. T. Pitt, Esq., showed the large heavily-blotched *Odontoglossum crispum Pittianum.*

P. W. Hooley, Esq., Southampton, showed *Lælio-Cattleya* × *Gottoiana.*

Mr. John Crook, Forde Abbey, Chard, showed very fine spikes of *Vanda teres*, grown in a cucumber-house.

Thos. Baxter, Esq., sent *Odontoglossum crispum morecambense* and *Odontoglossum crispum* 'Emily.'

R. I. Measures, Esq., Camberwell, showed *Miltonia vexillaria* 'Cambridge Lodge variety,' in which all the segments are more or less marked like the labellum.

De B. Crawshay, Esq., Sevenoaks (gr. Mr. Stables), sent *Odontoglossum crispum rosefieldiense.*

Henry Little, Esq., Baronshalt, Twickenham, showed two very fine dark-coloured *Lælia purpurata.*

The Hon. Walter Rothschild, M.P., Tring Park, sent *Lælia* × *purpurato-cinnabarina* and *L.* × *cinnabrosa.*

Orchid Committee, June 18, 1901.

Mr. Harry J. Veitch in the Chair, and thirteen members present.

Awards Recommended:—

Silver Banksian Medal.

To Messrs. B. S. Williams, Holloway, for a group of Orchids.

Award of Merit.

To Sophro-Cattleya × 'Geo. Hardy, Tyntesfield variety' (*Sophronitis grandiflora* × *Cattleya Aclandiæ*) (votes, 8 for, 3 against), from Fred. Hardy, Esq., Tyntesfield, Ashton-on-Mersey (gr. Mr. Stafford). The original reddish-scarlet form was shown May 10, 1898, and accorded an award of merit. From the same batch of seedlings, the Tyntesfield variety, with larger flowers, with sepals and petals blush-white, tinged and sparsely blotched with rose purple, and whitish labellum, veined and tinged with dark rose, was flowered.

Other Exhibits.

J. Gurney Fowler. Esq. (gr. Mr. J. Davis), showed a fine plant of *Cypripedium callosum Sanderæ*, with four flowers.

J Bradshaw, Esq., Southgate (gr. Mr. Whitelegge), sent *Lælio-Cattleya* × *Roeblingiana* (*C. Gaskelliana* × *L. purpurata*).

Reginald Young, Esq., Liverpool (gr. Mr. Poyntz), sent *Cypripedium* × *Kerchoveanum* (*Curtisii* × *barbatum*); *C.* × 'Ganymede' (*C. tonsum* ♀ × *C. œnanthum superbum* ♂), and *C.* × *Carnusianum*.

Mr. A. J. Keeling, Cottingley, Bingley, showed *Lælia* × 'Diana' (*L. Dayana* × *L. purpurata*), *Masdevallia* × *falcata*, *Lælia tenebrosa*, and *Miltonia flavescens*.

C. J. Lucas, Esq., Horsham (gr. Mr. Duncan), sent, as *Odontoglossum Lucasianum*, a variety of *O. Hallii*, suggested to be a natural hybrid between that species and *O. cristatellum*.

A. H. Smee, Esq., The Grange, Hackbridge (gr. Mr. Humphreys), sent *Pholidota obovata*.

Fred Hardy, Esq., showed the dark-coloured *Cypripedium Lawrenceanum nigrum*, and four *C.* × *Gowerianum*; also the original form of *Sophro-Cattleya* × 'Geo. Hardy.'

Orchid Committee, July 2, 1901.

Mr. Harry J. Veitch in the Chair, and fifteen members present.

Awards Recommended:—

Award of Merit.

To Schomburgkia Thomsoniana (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White). A fine species, with the habit of *S. tibicinis*, but smaller. Flowers yellow, with violet-purple front lobe to the lip.

Botanical Certificate.

To Aeranthes dentiens, from Sir Trevor Lawrence, Bart. Leaves coriaceous, dark green; flowers produced singly on the ends of long slender stems; pale green, with dark-green spur.

Cultural Commendation.

To Mr. W. H. Young, gr. to Sir Frederick Wigan, Bart., Clare Lawn, East Sheen, for a well-grown specimen of *Cattleya Gaskelliana* with nine flowers.

Other Exhibits.

Sir Trevor Lawrence, Bart., showed *Renanthera Imschootiana superba*, *Cypripedium* × *Wiertzianum* 'Burford variety,' and *Sobralia macrantha superba.*

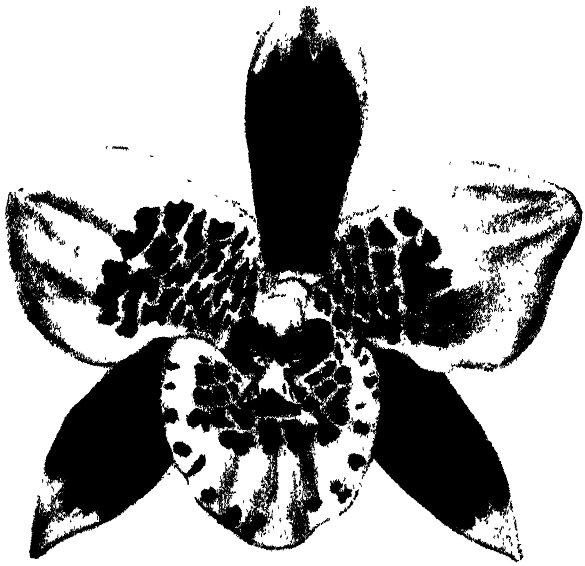


FIG. 264.—ODONTOGLOSSUM MACULATUM THOMPSONIANUM. (*Journal of Horticulture.*)

Sir Frederick Wigan, Bart., showed the nearly white *Cattleya Mendelii albescens.*

Mr. Ed. Kromer, Bandon Hill, Croydon, showed a profusely-flowered *Zygopetalum xanthinum.*

J. A. Timmis, Esq., Stone Hall, Oxted, sent *Cattleya Mossiæ* and *C. Warneri.*

ORCHID COMMITTEE, CHISWICK, JULY 16, 1901.

Mr. HARRY J. VEITCH in the Chair, and nine members present.

Awards Recommended :—

First-class Certificate.

To Odontoglossum maculatum Thompsonianum (votes, unanimous), from W. Thompson, Esq., Walton Grange, Stone, Staffordshire (gr. Mr.

W. Stevens). A gigantic form, with pale yellow flowers, marked with brown as in the type. The flowers were three inches across the petals, each of which was an inch and an eighth wide. The very strong inflorescence bore eight flowers. (Fig. 264.)

Award of Merit.

To Odontoglossum × Crawshayanum (*O. Hallii* ♀ × *O. Harryanum* ♂), (votes, unanimous), from de B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. Stables). The cross was made July 7, 1894, and the plant flowered July 12, 1901. In form and size resembling *O. Harryanum* in a great degree, but bearing the spiny crest, and apiculate column-wings indicative of *O. Hallii*, which species it also more nearly resembles in colour.

FIG. 265.—ODONTOGLOSSUM × CRAWSHAYANUM. (*Gardeners' Chronicle.*)

Sepals and petals pale yellow blotched with brown; lip primrose yellow, concave at the base, and spotted with purplish-brown; front lobe pale yellow, rolled inward on the fimbriate margin. (Fig. 265.)

To Cypripedium × Kimballianum 'Low's variety' (nat. hyb. *C. Rothschildianum* × *C. Dayanum*) (votes, unanimous), from Messrs. Hugh Low, Bush Hill Park. Flowers resembling *C. Rothschildianum* in most of the characters. Upper and lower sepals whitish, striped with dark brown; petals whitish, spotted with purple-brown; lip tinged with red-brown.

Other Exhibits.

Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H.

Young), showed flowers of a fine variety of *Cattleya* × *Whitei* (*C. Schilleriana* × *C. Warneri*).

E. Roberts, Esq., Park Lodge, Eltham (gr. Mr. Carr), showed a good specimen of *Anguloa Ruckeri*, with yellow flowers, lightly and evenly spotted with cinnamon-brown, as in *A.* × *intermedia*.

Reginald Young, Esq., Liverpool (gr. Mr. Poyntz), sent *Cypripedium* × *Tautzianum Youngii*.

Messrs. Hugh Low showed Cypripediums and *Cattleya Gaskelliana*.

Orchid Committee, July 30, 1901.

Mr. Harry J. Veitch in the Chair, and thirteen members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a collection of hybrid Lælio-Cattleyas.

First-class Certificate.

To Cypripedium × Maudiæ magnificum (*C. callosum Sanderæ* × *C. Lawrenceanum Hyeanum*) (votes, unanimous), from Capt. G. W. Law-Schofield, New Hall, Hey, Rawtenstall, Manchester (gr. Mr. Shill). Foliage and flower intermediate between the parents. Flower with emerald-green ground-colour, the upper part of the sepals and tips of the petals white, as in both the species used in its production. (Fig. 266.)

Award of Merit.

To Cypripedium × 'Mrs. Rehder, Oakwood variety' (*C. Argus* × *C. Rothschildianum*) (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam, Northumberland (gr. Mr. Wm. Murray). Flower of the *C.* × *Morganiæ* class. Upper sepal whitish, with many blotched chocolate lines; lower sepals similar, but with fewer lines; petals decurved, yellowish white, heavily blotched with large chocolate-purple blotches.

Other Exhibits.

Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), showed a number of spikes of hybrid Cattleyas and Lælio-Cattleyas &c.

C. J. Lucas, Esq., Warnham Court, Horsham (gr. Mr. Duncan), sent four good specimens of *Cypripedium* × *Clinkaberryanum warnhamense* (*C. philippinense* × *C. Curtisii*).

Capt. G. W. Law-Schofield showed *Cypripedium* × *Stottianum* (*Charlesworthii* × *œnanthum superbum*).

R. Tunstill, Esq., Monkholme, Brierfield, Burnley, showed *Cattleya Eldorado*, 'Monkholme variety.' Blush-white, with orange-coloured disc.

ORCHID COMMITTEE, AUGUST 13, 1901.

Mr. HARRY J. VEITCH in the Chair, and seven members present.

Exhibits.

Messrs. Jas. Veitch, Chelsea, showed a collection of hybrid Cattleyas and Lælio-Cattleyas.

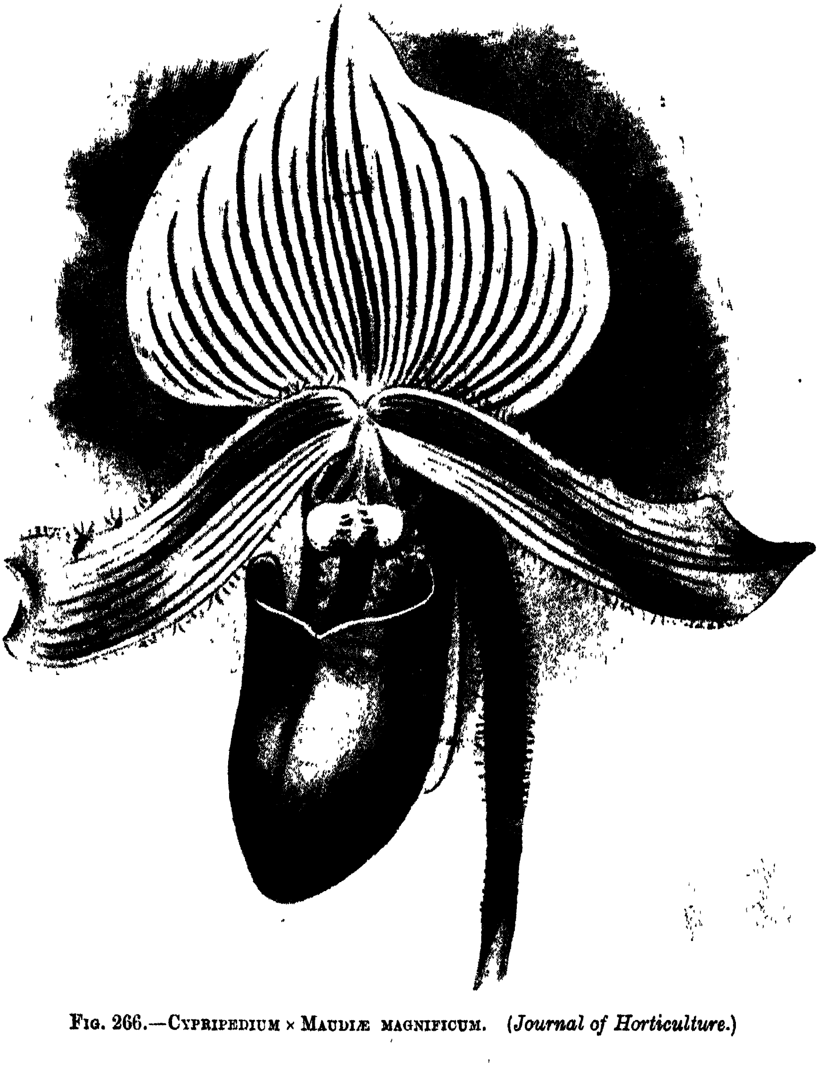


FIG. 266.—CYPRIPEDIUM × MAUDIÆ MAGNIFICUM. (*Journal of Horticulture.*)

Sir Jas. Miller, Bart., Manderston, Dunse, N.B. (gr. Mr. J. Hamilton), sent a hybrid between *Lælia tenebrosa* and *Cattleya granulosa Schofieldiana*, bearing a strong resemblance to *Lælio-Cattleya* × *elegans*.

J. S. Moss, Esq., Bishop's Waltham; sent a flower of *Lælia* × 'Iona' (*L. tenebrosa* × *L. Dayana*).

Horticulture)

ANO × C MENDELII, VEITCH'S VAR (*Journal of* *e page* cxcix)

(*To fa*